The control of onchocerciasis

by

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In this short communication, I do not intend to analyse all the different measures which have been applied, or suggested, for the control of onchocerciasis — the report of the first meeting of W. H. O. experts, held in Mexico last year, goes into this question in detail. I propose to discuss briefly what seem to me the important points regarding control of the disease in Africa. I shall confine my remarks chiefly to vector control, because drug prophylaxis has not been tried out on any scale, and in fact no really satisfactory drugs appear to have been discovered. In other words, the problem is Simulium control, and in recent years anti-Simulium campaigns have been successfully completed, both in Africa and in Canada. This insect is so susceptible to the new insecticides that its complete obliteration often seems feasible, and here we come to the first point where a decision has to be made. Is the campaign to be directed to elimination of the vector species or merely to amelioration? The type of method, extent of staff, and costs are all dependent upon whichever alternative is chosen. The choice will obviously depend upon the local conditions, but as a rule eradication should only be contemplated where the infestation is circumscribed. If the species extends over a very wide area — like in much of West Africa — then, unless the whole area is treated, re-infestation will quickly occur from the periphery of the treated zone. The less rigorous alternative may entail little more than hanging a few D.D.T.-impregnated strips of material in the streams. But this has to be repeated month after month; eradication means that the problem is solved for ever.

Unfortunately, opportunities for eradication are few — I shall mention 3 successful examples. The first relates to Léopoldville and the classical work of Wanson, Courtois and Lebied (1949). They applied D. D. T., atomized in an aeroplane exhaust, at the rate of 20 mgm. per sq. metre to vegetation on the Congo river for 26 succes-
sive days. Adult Simulium damnosum on emergence from the pupal case came into contact with the deposit and were virtually exterminated after this treatment. A few areas became re-infested some months later, but aerial treatment was repeated and Léopoldville has now remained free from the insect for several years. Wanson's work means therefore that we may now enjoy the hospitality of this city to the full!

The second example of eradication occurred in Kenya, where McMahon and I (1947 and 1954) applied D. D. T. emulsion to rivers in a localized S. neavei area near Lake Victoria. The dosage was 2 parts of D. D. T. per million of water dripped from perforated cans at the upper limit of the infestation and repeated at fortnightly intervals for 5 months. This dosage was well above what we now know to be the M²D (0-5 parts). Adults disappeared in a month from the start and subsequent close searches up to September, 1953 have failed to reveal a single fly. During the interval skin microfilaria rates in children between 4 and 8 years of age have dropped from 37 to 5 per cent whilst the clinical manifestations of the disease in the whole population have been reduced by about 90 per cent.

The third example also comes from Kenya, where Buckley (1951) succeeded in getting rid of S. neavei by discriminative bush-clearing. He removed all the undergrowth and the smaller trees from the banks of two fly-infested rivers in an isolated focus. The bush clearing had to be repeated, but 5 years from the start the species was extinct. This biological method of control was based on the observation that S. neavei was only found on well-wooded river banks; if the environment was changed it was thought — and rightly — that the insect would not be able to survive.

Attempts at eradication by larvicidal methods on a very wide scale have been made recently by Barnley (1953) on the Nile (S. damnosum) and by McMahon in the Kakamega Forest (S. neavei). The first campaigns were almost successful and others are now in progress, and these may show us whether the method can result in complete success over an extensive area.

Two factors are essential for the success of an eradication programme: the whole terrain must be subjected to the most detailed Simulium survey, including finding out both the exact distribution and limits of the vector species and its habits — e.g. flight range and maximum life of the adult. The second factor is the provision of an organization capable of carrying out firstly measurement of river flow, and secondly applications of insecticide which will cover the whole area in a restricted space of time — say 14 days; if
portions of the area are treated consecutively instead of simulta-
neously, there is bound to be re-infestation, or if the time intervals
are too long, some adult females will escape and another generation
will become established.

These pre-requisites for success are unlikely often to be present,
and in most places, ameliorative measures alone are possible. These
can be most useful, and I should like to refer to one example of
control — not by action on the vector, but on the parasite. I refer
to the Mexican campaign of denodulization which has altered the
whole outlook in that country where onchocercal blindness has been
reduced to vanishing point and Brumpt's local name of Onchocerca
caecutiens (= the blinding Onchocerca) is more than ever justifiably
replaced by O. volvulus! The Mexicans have itinerant teams
of workers who tour the countryside removing nodules — chiefly
from the head — after a preliminary local anaesthetisation of the
skin. Similar work has been done in Guatemala.

Simulium breeding has been controlled in Canada (Fredeen et al.,
1953) in recent years by modified methods which may interest
workers in the tropics. In the Saskatchewan Rivers the insect was
nearly wiped out by single applications of D.D.T. (in methylated
naphthalene and kerosene) at a dilution of 0.1 p.p.m. for 15 minutes,
over stretches of up to 115 miles. This extraordinary result was
apparently due to the presence in the water of very-fine silt, which
absorbed the insecticide and carried it for long distances down
river. Simulium larvae ingest the silt and die from the effects even
more easily than after surface contact. For success, it is necessary
that the river should be free from aquatic vegetation and should
contain silt in a finely suspended form. It has been suggested that
D.D.T. already absorbed on a suitable dust might be useful, but
no formulations have yet been prepared. Thermal generated aeros-
sols have proved effective in the local control of forested areas in
Northern Canada (Peterson, 1952) — for instance D. D. T. applied
by a Tifa. There are so many practical difficulties associated with
aerosols that it is doubtful if the method could be used on a large
scale, and even in Canada, its use was confined to small places like
military camps where daily treatment was necessary — a procedure
reminiscent of the spraying of houses with pyrethrum in the tropics.

Other methods exist for the control of Simulium, but as far as
I know, none has been put to any real test in the field. An attack
on the crab — the phoretic host of S. neavei — is an obvious possi-
bility, but I believe that McMahon (1951) who has studied this
problem so much has yet to devise a feasible way of getting rid
of crabs. Control of S. damnosum by variation of the water level
might prove of value, and I think that certain entomologists in West Africa have found out new facts about the life-history of this species, which may lead to practical methods of control. There are, of course, innumerable ways of applying the insecticide itself — including the grotesque « excelsior sausages » and « D. D. T. chuckers » which were dropped by helicopter in the Canadian work (Hocking, 1953)!

A potential biological method of control which appeals to me is the use of microsporidia which can devastate the larvae. I remember Professor Wanson telling me how common the infection was in streams near Léopoldville, and I have found _Simulium_ in Europe, extensively parasitized with this protozoon. Perhaps the introduction of an exotic species might be worthy of trial.

For personal prophylaxis for individuals against this disease nothing could be simpler: the use of a repellent like di-methyl phthalate. But for communities sparsely spread over a large area and possibly overlapping into other territories, there is no easy solution. The answer may come via chemo-therapy, but the more satisfactory one is surely the entomological approach, because, as often as not, _Simulium_ not only carries _Onchocerca_, but is in itself so much of a pest that it will depopulate large districts.

_Summary._ — Onchocerciasis can be controlled, either by attacking the parasite or by killing the vector. Drugs of proven prophylactic value have still to be found, and the disease at present is best prevented by _Simulium_ control. In Mexico, the parasite itself can be successfully eliminated by « denodulisation » and the worst effects (blindness) disappear; but in Africa this method is inapplicable.

_Simulium_ control may be either absolute (leading to eradication) or partial (leading to amelioration). Eradication requires an exact knowledge of the vector species and an organisation capable of carrying out a campaign over the whole area simultaneously. It cannot be done zone by zone, because of the danger of reinestation of the zones treated first. Opportunities of eradication are therefore limited. Three examples are described, in which different methods were employed — in Léopoldville (D. D. T. aerial spraying), in Kenya (D. D. T. as larvicide), and in Kenya again (discriminative bush clearing).

_Simulium_ is so susceptible to the newest insecticides that quite crude methods will succeed in controlling the pest. In Canada a single minute dose of D. D. T. will control breeding for over 100 miles, the insecticide is absorbed on finely suspended silt, the
larvae swallow it and die. Thermal generated aerosols temporarily get rid of the insect and can be used around military camps, etc.

Other methods of control — chiefly biological — are briefly mentioned, but none have been employed in the field on a wide scale.

Personal prophylaxis is simple (use of a di-methylphthalate repellent), eradication of isolated foci is sometimes practicable, but a suitable method of control for large territories, as in much of West Africa — has yet to be found. The *sine qua non* for any method (except the chemo-therapeutic) is precise entomological data.

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REFERENCES.


