VECTOR CONTROL OF FILARIASIS IN THE SOLOMON ISLANDS

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INTRODUCTION

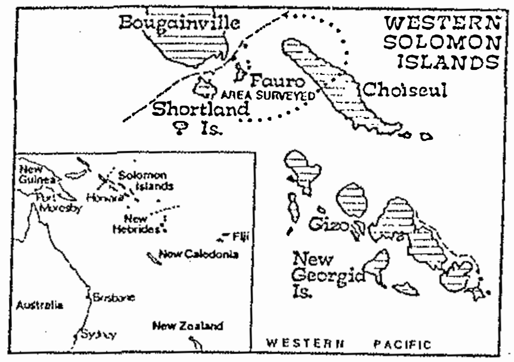
Filariasis in the Solomon Islands is nocturnally periodic, caused by *Wuchereria bancrofti* and transmitted by *Anopheles farauti*, *Anopheles punctulatus* and *Anopheles koliensis* (Byrd and St. Amant, 1944, 1959; Schlosser, 1945). These three vectors are also responsible for the transmission of malaria in the islands. A Malaria Eradication Programme was commenced in 1960, so it was reasonable to assume that filariasis might be controlled as well. The present study explores some of the effects of the Malaria Eradication Programme on filariasis. This may serve as a general example of the effect of malaria control on filariasis transmission, where there is a common *Anopheline* vector such as rural bancroftian filariasis in Southeast Asia.

MATERIALS AND METHODS

Map 1 shows the area studied. The north west end of Choiseul Island was compared with Fauro Island and part of the Shortlands. The people of these islands are very similar and although separated by sea have always had considerable contact with each other. The part of Choiseul studied consisted of two complete ethnic sub-groups, making a reasonable demarcation from the rest of the island.

The Malaria Eradication Programme was begun in the Shortlands group in 1960, but not until 1968 in Choiseul. The present survey was conducted between November 1970 and March 1971.

An attempt was made at total population coverage. This was virtually achieved on



Map 1—Showing the area where the survey was conducted.

Fauro and the selected villages on Shortland Island; it was found to be more difficult on Choiseul, but the population sampled was representative.

All blood films were taken between the hours 2000-0200. The method used was to visit the village in the daytime and explain to the headman and villagers the purpose of the survey. All cases of elephantiasis were examined. The majority of the blood slides were taken by the author that same night, using the Council Clerk as recorder-interpreter.

Owing to the villages being situated on the coast with no connecting footpaths, all communications being by canoe, only one village with an average of 50 people could de examined each night. So each village was visited in turn from the base by a dinghy with outboard-motor, and the daytime visit had the equally important purpose of learning the passage through the reef for the nighttime return.

Blood films were taken. These were stained rapidly with Field's stain and were

Table 1

Results of surveys on Choiseul and Shortland 2 years and 10 years after the start of vector control.

Island	No persons exam.	Microfilariae		No. with elephantiasis	Percentage with elephantiasis
		No. positive	Percentage positive		
Choiseul	1,385	209	15.09	11	0.79
Shortland	376	1	0.27	7	1.86

all examined and the species and number of microfilariae determined for each 20 c.mm blood sample taken.

RESULTS

A survey of filariasis carried out after vector control had been continuously in operation in the Shortland Islands for 10 years and in Choiseul for 2 years gave the results set out in Table 1. An examination of the figures strongly suggests that a considerable reduction in filariasis has been produced by vector control methods alone. The above statement presupposes the following suppositions:

(1) That the level of endemicity of filariasis in the Shortlands was similar to that in Choiseul prior to anti-mosquito measures.

(2) That the level of endemicity of filariasis in Choiseul has so far not been affected, or only slightly affected, by vector control methods.

(3) That no other control methods (e.g. mass drug administration) have been in operation.

The last supposition is the easiest to confirm because it is a statement of fact. Treatment of cases using Banocide (diethylcarbamazine) has been on symptomatic criteria, with probable re-infection on return home. No mass drug administration has been carried out in the Solomon Islands, on financial grounds.

DISCUSSION

Pre-control endemicity of filariasis in the Shortlands : It is unfortunate that there are no reliable pre-spray survey data on this area of the Solomons. However, it is unlikely that filariasis would be any different here from other parts of the Solomons and especially from the neighbouring area of Choiseul. The strongest evidence is given by the elephantiasis cases which are very similar for age and sex distribution in both the Shortlands and Choiseul. Indeed the youngest case of elephantiasis found in Choiseul was a male aged 21 and in the Shortlands (Fauro Island) a female of 27, suggesting intense, recent infection. In order to obtain this level of elephantiasis, the pre-control levels of filariasis will have needed to be similar.

An estimate can be obtained by comparing the prevalence of elephantiasis of 1.86 per cent with other areas of the Pacific (Kessel, 1957). This will give a figure of approximately 30 per cent.

Effect of control methods on the endemicity of filariasis in Choiseul : The figures for Choiseul suffer from the same difficulty as those in the Shortlands, in so far as there are no baseline data. However, the clock cannot be put back and circumstances dictated that this survey be conducted in this particular part of the Solomons at this time.

In view of the long life history of the adult worm (various estimates put it at about 10 years), it would be anticipated that interruption of transmission would have little effect on microfilarial rates and densities for some time. In comparing the Choiseul figures with other surveys carried out in the Solomons (Webber, 1973), the results are conflicting. While there is little evidence of change in the percentage positive, the microfilarial density is lower than expected. Here also, there are difficulties in comparing arithmetic means, and the MfD_{50} as proposed by Sasa (1967) should be calculated for more data than are available. This limitation of data prevents any further analysis of the problem here, but in a subsequent paper a theoretical answer is suggested.

Vector control campaigns against filariasis: No filariasis campaigns have had any persisting success with vector control methods alone, but concomitant reduction of filariasis in other Malaria Eradication Campaigns (Iyengar *et al.*, 1959; Van Dijk, 1964) have been observed. In another part of the Solomon Islands, Mataika (1965) surveyed Guadalcanal 3 years after residual spraying had been in operation and compared this with an unsprayed island; however, there is sufficient baseline data for Guadalcanal (Webber, 1973) to give a direct comparison indicating that there was a significant decrease in microfilaraemia, as shown in Table 2.

If the various pieces of evidence mentioned are accepted as suggesting that filariasis has been controlled by vector reduction so far, then possible alternatives must be considered as a precaution for future changing circumstances.

Alternative vectors : The original study on the vectors of filariasis in the Solomon Islands was conducted in 1944 (Byrd and St. Amant, 1944) and apart from the experimental work by Mataika (1965), it has not been repeated. While *A. farauti*, *A. punctulatus* and *A. koliensis* are incriminated, *Mansonia uniformis* and *Culex pipiens fatigans* were also shown to sustain the development of microfilariae, but not to maturity.

Mansonia uniformis has been found to be a vector in similar topographical conditions in West Irian (De Rook, 1957 ; Van Dijk, 1958), whereas Mataika (1965) succeeded in experimentally infecting 2 (4 %) of *Culex fatigans* with infective larvae from an indigenous Solomon Islands microfilaria carrier. De Rook and Van Dijk (1959) have reviewed the "Changing concept of *W. bancrofti* transmission in West Irian", and amongst more species than mentioned here which could become alternative vectors, they particularly mention these two. They observe that *M. uniformis* which commonly breeds in freshwater swamps prefers to bite out of doors, so probably rarely comes into contact with residual spraying. *Culex fatigans* although a comparatively rare mosquito in the Solomons is well known to take advantage of changing ecological conditions and its ability to develop DDT resistant strains

Table 2

Comparison of pre-control and post-control data on microfilaraemia in Guadalcanal.

	No. examined	No. positive for microfilariae	Percentage positive for microfilariae
Guadalcanal before spraying	3,035	762	25.1
Guadalcanal 3 years after spraying	502	94	18.7

$P < 0.001$.

could pose a serious problem as an alternative vector of filariasis.

The recently reported discovery of filariasis on Bellona Island (Eyres, 1972) which was known to be free previously (Black, 1952) and has always been thought to have no *Anopheles*, leads to speculation as to the possible vector.

Duration of vector control methods : If positive microfilaraemia is exhibited for some 10 years after cessation of transmission, then ideally anti-mosquito measures should be continued for this time. This will mean very considerable expense in controlling a non-fatal disease at a time when a very small proportion of people are suffering from it. There is also the problem of insecticide resistance developing with prolonged application, although in the particular case of the Solomon Islands there has been no suggestion of this so far.

The spraying programme is determined by malaria reduction which is the prime object of the Malaria Eradication Programme, but as the level of microfilaraemia is likely to fall off rapidly after about three years, there would be no need to extend the attack phase of the campaign. Instead, regular surveys will need to be required using more sensitive techniques (Southgate, 1973; Desowitz and Southgate, 1973; Desowitz *et al.*, 1973), and all positive cases treated with diethylcarbamazine. These will need to be continued until about 12 years after commencing the programme.

SUMMARY

In the Solomon Islands, filariasis is caused by the nocturnally periodic form of *Wuchereria bancrofti* and is transmitted by the same vectors as malaria. This study explores the control of this disease as an additional effect of the Malaria Eradication Programme.

A survey was conducted in part of the Western district measuring the microfilarial and elephantiasis rates of an area that has been sprayed with residual insecticide for 10 years and comparing these with another sprayed for 2 years. In the more recently sprayed island 15% of the population had microfilariae and 0.8 % elephantiasis, whereas in the Shortland Islands 0.2 % had microfilariae, but 1.8% elephantiasis.

This apparent decrease of microfilaria positives in the Shortland Islands is compared with a similar situation in West Irian and a previous survey in Guadalcanal, indicating that filariasis has been controlled by vector reduction alone. However, there is the possibility that an alternative vector could appear, apart from the unreasonable extension of residual spraying to some 10 years, so it is suggested that after the attack phase of the Malaria Eradication Programme, surveillance be substituted and all microfilaria positives given drug therapy.

REFERENCES

BLACK, R.H., (1952). *Malaria in the British Solomon Islands Protectorate.* Noumea, New Caledonia : South Pacific Commission Technical Paper No. 33.

BYRD, E.E. and ST. AMANT, L.S., (1944). *Report on the findings of the Filaria Survey Unit in the Solomon Islands.* United States Navy (mimeographed document).

BYRD, E.E. and ST. AMANT, L.S., (1959). *Studies on the epidemiology of filariasis on Central and South Pacific Islands.* Noumea, New Caledonia : South Pacific Commission Technical Paper No. 125.

DE ROOK, H. and VAN DIJK, W.J.O.M., (1959). Changing concept of *W. bancrofti* transmission in Netherlands New Guinea *Trop. Geogr. Med.*, *11* : 57.

DESOWITZ, R.S. and SOUTHGATE, B.A., (1973). Studies on filariasis in the Pacific. 2. The persistence of microfilaraemia in diethylcarbamazine treated populations of Fiji and Western Samoa : diagnostic application of the membrane-filtration technique. *Southeast Asian J. Trop. Med. Publ. Hlth.*, *4* : 179.

DESOWITZ, R.S., SOUTHGATE, B.A. and MATAIKA, J.U., (1973). Studies on filariasis in the Pacific. 3. Comparative efficacy of the stained blood-film, counting chamber and membrane-filtration techniques for the diagnosis of *Wuchereria bancrofti* microfilaraemia in untreated patients in areas of low endemicity. *Southeast Asian J. Trop. Med. Publ. Hlth.*, *4* : 329.

EYRES, B., (1972). Tour report of Bellona, May 1972. Honiara, Solomon Islands : Medical Department.

IYENGAR, M.O.T., DE ROOK, H. and VAN DIJK, W.J.O.M., (1959). Interruption of transmission of *Anopheles*-borne filariasis by indoor residual spraying in Netherlands New Guinea. *Trop. Geogr. Med.*, *11* : 287.

KESSEL, J.F., (1957). Disabling effects and control of filariasis. *Amer. J. Trop. Med. Hyg.*, *6* : 402.

MATAIKA, J.U., (1965). *A study of filariasis in Solomon Islands.* Honiara, Solomon Islands : Medical Department.

SASA, M., (1967). Microfilaria survey methods and analysis of survey data in filariasis control programmes. *Bull. W.H.O.*, *37* : 629.

SCHLOSSER, R.J., (1945). Observations on the incidence of *W. bancrofti* larvae in the native poplation of the Solomon Islands area. *Amer. J. Trop. Med.*, *25* : 493.

SCHLOSSER, R.J. and REIBER, R.J., (1945). *Anopheles punctulatus* found to mature both *Plasmodium* and *Wuchereria* on Guadalcanal. *Hdqrs. Newsletter Mal. Epidem. Control, S. Pacif.*, May, 1945.

SOUTHGATE, B.A., (1973). Studies on filariasis in the Pacific. 1. A field trial of a counting-chamber technique for the determination of microfilarial rates and densities. *Southeast Asian J. Trop. Med. Publ. Hlth.*, *4* : 172.

VAN DIJK, W.J.O.M., (1958). Transmission of *Wuchereria bancrofti* in Netherlands New Guinea. *Trop. Geogr. Med.*, *10* : 21.

VAN DIJK, W.J.O.M., (1964). Control of *Wuchereria bancrofti* filariasis in West New Guinea *Trop. Geogr. Med.*, *16*: 54.

WEBBER, R.H., (1973). Filariasis in the Solomon Islands and its reduction by vector control methods. University of London : D.T.P.H. dissertation.