

P. 2
1984

Twenty-five years of blackfly control in a localized moist forest area of Cameroon: a review

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mortality more than 33 km from its application point with a river discharge of 520 m³/sec. After 5 years of uninterrupted treatment, a slight decrease in susceptibility to this compound was detected but an unintentional interruption of treatment for more than 6 months led to a return of the susceptibility to its initial level. This compound is at present used for the protection of the Song Loulou dam site at one spraying point in the rainy season and at 2 points during the low discharge period.

Future of anti-blackfly control at Song Loulou

The performance required for anti-blackfly larvicides (efficacy, range, low toxicity, selectivity, good physical characteristics) already limits the choice of available compounds. The multi-resistance phenomena recorded in the study zone and the high discharges considerably reduce the number of alternatives to permethrin (Discussion, below). Although at that time no decrease had been observed in the efficacy of DDT, this organochlorine compound could no longer be used for safety reasons. Furthermore, susceptibility tests carried out by LOCHOUARN *et al.* (1987) have shown that temephos resistance has not decreased and that the return of susceptibility to chlorphoxim was only partial (Fig. 2). In order to reduce the chances of resistance developing to permethrin, and relying on the experience gained in the vector control programme in West Africa concerning resistance management (KURTAK, 1986), the use of 2 additional insecticides should be considered immediately, i.e., one chemical insecticide, pyraclofos, and one biological insecticide, *Bacillus thuringiensis* H-14.

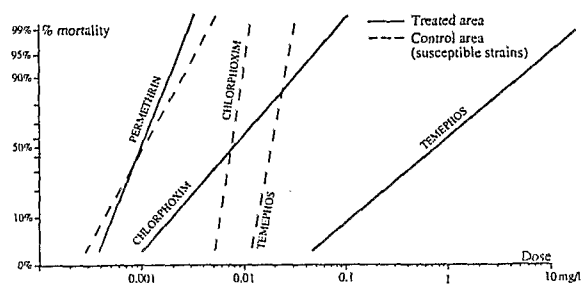


Fig. 2. Present status of the susceptibility of blackflies to permethrin, chlorphoxim and temephos after 25 years of larviciding in Cameroon.

to the authors. However, these results have to be considered carefully because they emphasize the importance of the treatment protocol as well as the hydrological conditions of the river, both of which are of great significance in the future of larval control operations.

The treatment protocol is responsible to a large extent for the appearance of multiresistant strains because the stretch treated (some 50 km) has been constantly subjected to reinvasion by blackflies from sites upstream (Log Pagal) or, in the case of insufficient 'carry', downstream from Song Ndong to Edea (*S. squamosum* is practically absent from the tributaries of the river). The consequence of this reinvasion has been the need to maintain the weekly periodicity of the treatments while, downstream of the spraying point, the insufficient 'carry' and the resultant under-dosage have favoured the appearance of resistant strains. This phenomenon has forced the adoption of compounds which, though acceptable from the environmental point of view, are sometimes more toxic for the non-target fauna while being more expensive and often less effective (needing 2 spraying points instead of one).

The hydrological conditions of the river considerably reduce the choice of compound. The Sanaga is the most important river in Cameroon and its discharge, which ranges between 400 m³/sec during the low water period and more than 8000 m³/sec during the high water period, permits it to be classified among the biggest rivers in tropical Africa. In addition to this characteristic, there is, on a great part of its course, particularly between Sakbayeme and Song Loulou, a fast current due to a series of rapids covering some 100 m in a length of 18 km (DUBREUIL *et al.*, 1975). These hydrological conditions favour insecticide 'carry' and therefore limit the number of spraying points needed but, on the other hand, the high discharge necessitates weekly spraying of great quantities of insecticide, particularly during the rainy season which, in these latitudes, lasts more than 9 months.

The treatment protocol and the hydrological conditions are therefore the 2 factors which, indirectly, increased the cost of larviciding at the site. At the height of the rainy season, up to 400 litres of permethrin can be sprayed in a single weekly spraying, should the discharge reach 6000 m³/sec. However, compared to the quantities of insecticides required by the Onchocerciasis Control Programme in West Africa, where several thousand kilometres of river have been treated each week for more

chocerciasis vector control campaign, which is also of local importance, has made it possible to reduce the blackfly biting rate by 60% at a cost of about US\$ 12 000 per year (HOUGARD *et al.*, 1990).

S. squamosum is a vector of onchocerciasis in southern Cameroon, but this is not considered a serious problem at Song Loulou, compared to other areas of the Sanaga basin where the skin lesions are serious and many of the patients are blind (J. P. Chippaux, personal communication). Nevertheless, the high population density at this site has led the health service to distribute ivermectin a

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