Methods at present available for *Stegomyia* control

A. W. A. BROWN

Vector Biology and Control, WHO, Geneva

The standard method to control *Aedes aegypti* has been the perifocal method, where breeding sites are treated to kill the larvae in the water, and the adults as they emerge and settle on the sprayed surfaces around the water body. This treatment is normally repeated every two/three months. For this, 2.5 % emulsions or suspensions of DDT have been widely used, or alternatively 1 % formulations of dieldrin or gamma-HCH. Due to the widespread dieldrin-resistance in Africa, as in the Americas, often accompanied by DDT-resistance, the organophosphorous insecticides are now substituted. Malathion at 2.5 % is satisfactory, but Gardona at the same dosage has a longer residual effect, while 1 % formulations of fenthion or Dursban are equally effective and long-lasting.

The preceding treatments are suitable for treatment of non-potable water and of outdoor breeding sites such as discarded containers, tyres and tree-holes. For potable water such as is commonly stored indoors in pots in Africa, the larvicide that should be used is Abate, which is remarkably non-toxic to higher animals. It is formulated with sand granules to give a 1 % formulation, and the pots are treated with an amount to give 1 ppm Abate, e.g., 1 gram of the sand granules is used to treat 10 litres of drinking water. This treatment keeps the water free of all larvae for two months, and the period of protection of the second treatment is at least three months. There are no taste effects and the treated water is completely safe.

When a village or town quarter is treated with Abate granules, the full effect on the adult population does not develop until two weeks after the treatment. Thus for complete and immediate control of *Aedes aegypti,* space treatments in the form of mists or fogs are applied to kill the adult mosquitoes. When Swingfog thermal aerosol applications were used to disperse a 4 % solution of malathion in diesel oil at a malathion dosage or 3 fl. oz/acre (220 ml/ha) in Bangkok, Thailand, the population of adult *Ae. aegypti* was reduced by 99 %. But when not supplemented by larvicidal treatment, the population returned to normal within one week of the fog application.

If adulticide treatments are to be used, a longer period of protection is given by the use of mist-blowers which produce droplets with a mass median diameter of 50 microns instead of the thermal fog applications which produce droplets with an m.m.d. of 10 microns, and which disperse a 99 % concentrate of malathion instead of a 4 % solution. This ULV (ultra-low-volume) method of dispersing concentrates may be practised with the mist-blower known as the « Mity-Moe ». Application of malathion at 3 fl. oz/acre (220 ml/ha) from the mist-blower did not have such an immediately decisive effect as the fog applicator, but it was more long-lasting, and it took weeks for the population of *Ae. aegypti* to recover to 50 % of its normal level. For ULV dispersal of malathion from the ground, fog machines which disperse coarse aerosols without thermal treatment are suitable (e.g., Leco cold fogger, Curtis cold aerosol generator).

The most decisive way of utilizing the ULV method is to employ aircraft to treat whole villages or towns, although the dosage must be increased to 6 fl. oz/acre (440 ml/ha). When a Cessna 180 aircraft, emitting malathion concentrate through 800067 flat-fan nozzles at 100 psi (7 kg/cm^2) pressure, treated villages near Bangkok, 100 % kills of *Ae. aegypti* were obtained in the open and 65 % mortality inside the houses ; however, the populations recovered their numbers within one week. When a Dakota (C-47) aircraft, emitting ULV malathion through 80008 nozzles at 46 psi (1.1 kg/cm^2) pressure, treated the town of Nakhon Sawan (50 000 inhabitants), it obtained 92-95 % control until a second application four days later, which kept the control above 90 % for the next

six days. The entire 18 km2 area was treated in a single flight of the aircraft emitting 870 L. (230 gals US) in 45 minutes. A single application made at 3 fl. oz/acre obtained 93 % control initially, but five days afterwards it had fallen to 65 %, 10 days after to 40 %, and the population had returned to normal 12 days after the application. The installation of the small boom-and-nozzle assembly on the C.47 aircraft takes only four hours ; it has been fully described by LOFGREN *et al.* (1970 c).

Aerial ULV applications are also effective against *Aedes simpsoni*. In trials performed in southwestern Ethiopia over plantations of the false banana (*Musa ensetta*) in whose leaf-axils this mosquito breeds, malathion at 6 fl. oz/acre obtained 75-90 % control of the adults by the third day after the application. A Piper PA-18 aircraft was employed, equipped with two Micronair rotary atomizers delivering droplets of 40-55 microns mass median diameter. Applications with malathion at 20 fl. oz/acre (1 500 ml/ha) obtained 93-100 % reduction of the adults by the third day.

There are no examples of successful genetical control of *Ae. aegypti*, a trial with radiosterilized males at Pensacola, Florida having been ineffective. Neither hybrid sterility nor cytoplasmic incompatibility is available for this species. Experiments with chemosterilized males will be made by the WHO Unit for Genetical Control at Delhi, India. This Unit will also investigate the control effect of strains of *Ae. aegypti* bearing chromosonal translocations, which cause sterility not only in the first generation but also in succeding ones.

For biological controle of *Ae. aegypti* one possibility is the mosquito genus *Toxorhynchites* whose larvae are predacious on *Stegomyia* larvae. It is planned that. *T. brevipalpis* will be liberated on Bungoyo Island off the coast of Dar-es-Salaam where at present *aegypti* is abundant and the predator lacking. The advantage of a flying mosquito predator to search out the multiplicity of small breeding places of *Ae. aegypti* is obvious.

Manuscrit reçu au S.C.D. le 23 novembre 1971.

REFERENCES

BANG, Y. H. *et al,* 1970, *Mim. Doc.* WHO/VBC/239, 9 pp.

BROOKS, G. D. *et al.*, 1970, *Bull. Wld Hlth Org.* **42,** 37-54.

KILPATRICK, J. W. *et al.*, 1970, *Bull. Wld Hlth Org.* **42,** 1-14.

LOFGREN, C. S. *et al.*, 1970 a, *Bull. Wld Hlth Org.* **42,** 15-25.

LOFGREN, C. S. *et al.*, 1970 b, *Bull. Wld Hlth Org.* **42,** 27-35.

LOFGREN, C. S. *et al.*, 1970 c, *Bull. Wld Hlth Org.* **42,** 157-163.

MOUNT, G. A. *et al.*, 1970, *Mosquito News* **30,** 56-59.

X., Insecticide Resistance and Vector Control, 1970, *Wld Hlth Tech. Rep.*, Ser. No. **443,** 279 pp.