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Expanded polystyrene balls: an idea for mosquito control

Cess pits and pit latrines are classic breeding places for the urban mosquito *Culex pipiens fatigans* Wied., and are important in the increasingly serious problem of urban filariasis (Mattingly, 1969). In many countries oiling is still the method of choice for controlling this mosquito, although the technique is often fairly ineffective and uneconomical. A number of insecticides have given better results, but resistance to organochlorine and organophosphorous compounds exists in several parts of the world (Pant *et al.*, 1977).

The idea presented here is that a floating blanket of expanded polystyrene balls might provide a simple, inexpensive and relatively permanent method of reducing the breeding potential of *C.p. fatigans* in domestic habitats without incurring the problem of resistance.

Expanded polystyrene mouldings are now commonly used for packing and insulation. The mouldings are made from spherical beads of polystyrene containing 5–7% of pentane. When the beads are heated to a temperature above 95°C, the polystyrene begins to soften and the pentane is rapidly released from solid solution, causing them to expand. If the beads are allowed plenty of room for expansion they form discrete balls of the familiar soft white material.

Expanded polystyrene balls (EPBS) are light (10–15 kg m^{-3}). They are not affected by water and are biologically inert. On water they readily arrange in a close-packed array. In multiple layers the first two or three layers are wetted but higher ones remain dry. Such multiple layers form a fairly stable 'blanket' over the water: solids or liquids can be dropped through it without forming a 'hole'. The balls can be forced aside by horizontal sweeping, but provided that the gaps are not too great the cover soon reforms, especially when aided by gentle rippling.

Laboratory tests showed that a double layer of EPBS killed all third and fourth instar *C.p. fatigans* larvae, which were unable to penetrate the plastic barrier and so died of anoxia. With a single layer of EPBS the larvae occasionally managed to penetrate, and some survived to pupation. Pupae showed a remarkable ability to force their way up through the first layers of EPBS and occasional successful eclosions were noted (Table).

Adult females laid their egg rafts on the water in the interstices between EPBS when these were limited to a double layer. Larvae from these eggs developed normally in the first and second instars, obtaining air by wriggling up between the EPBS. Third instar larvae were unable to do this and died soon after ecdysis. Egg-rafts were never laid when the top EPBS were dry although female mosquitoes worked their way down through the dry layers for up to 1 cm.

These preliminary observations suggest that a layer of EPBS, 3–5 cm thick, could be used to control mosquitoes breeding in still water, polluted or clean, provided that the

TABLE

Percent mortality of Culex p. fatigans *in the presence of expanded polystyrene balls (mean of 12 replicates in each case)*

Instar	*No. of layers of EPBS* 1	2	3
IV	93	100	100
Pupae	3	40	72
Pupal adult eclosion	17	88	100

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habitat is shaded from the wind. The material is readily available in many countries throughout the world. Expansion of the plastic could be effected close to the target sites simply by cooking the pre-expanded beads in boiling water in an open vat. At altitude, a pressure cooker or autoclave would have to be used to compensate for the reduced boiling point of water. More sophisticated devices would be required for large scale production, but these are available and are not too expensive. Application could be by hand, or by using a Venturi device powered by compressed air.

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