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INTEGRATION OF CHEMICAL AND BIOLOGICAL CONTROL  
PROCEDURES AGAINST MOSQUITOS

by

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Stern, et al. (1959) defined integrated control as "pest control which combines and integrates biological and chemical control". Integrated control allows for the application of chemical insecticides as required but such insecticides are used in a manner which is least deleterious to biological control agents. Franz (1960) suggested that integrated control should be broadened to include all artificial pest control measures and cultural practices with biological control.

Little effort has been expended to incorporate the desirable features of chemical and biological control procedures into mosquito control programmes; however, the comparative values of each procedure and the possible utilization of an integrated control programme against mosquitos have been considered by Lewallen (1960) and Mulla (1961). At present, no intense and thorough research programme is investigating the integrated concepts of chemical and biological control of mosquitos.

Information concerning dosage rates and formulations of insecticides and the selective activity of certain organo-phosphorus and carbamate compounds has suggested that mosquito control may be possible without unduly affecting natural predators in the same environment (Lewallen & Brydon, 1958; Mulla & Isaak, 1961).

Laboratory tests on an invertebrate predator, Tropisternus lateralis, a hydrophilid beetle, indicated that dosage levels of certain insecticides may kill mosquito larvae without harming the predator. Other compounds exhibited a broad spectrum of toxicity to both predator and mosquito (Lewallen, 1962). Utilization of compounds in mosquito control programmes that are safe to vertebrate and invertebrate predators could do much to demonstrate the effectiveness of the integrated control approach.

In California the rice field habitat with attendant mosquito control problems, but possessing a rich fauna of natural enemies of mosquitos, would lend itself well to a study of the feasibility of integrating chemical and biological control measures. Under these conditions, preservation of natural enemies when chemical control is required could lead to a well-balanced programme of integrated control if properly planned. Limited studies on the effects of the non-selective insecticide DDT in rice fields indicate that natural controls are adversely affected when this insecticide is used in mosquito control programmes (Gerhardt, 1955).

Despite the paucity of information currently available on integrated chemical and biological approaches to mosquito control, sufficient knowledge is available to indicate the feasibility of the method. More research in this area may lead to drastic alteration of present chemical control practices, which rely almost exclusively on the application of chemicals.

Although source reduction or cultural control is practised in mosquito abatement, control is largely based on the application of insecticides. The repeated use of chemicals has frequently led to the development of insecticide resistance; utilization of natural controls supplemented by chemical methods may help to forestall the further development of resistance to new compounds.

Attention should also be directed toward the utilization of microbial agents combined with insecticides for mosquito control. This may be especially useful where resistance to insecticides has developed; microbial agents may weaken mosquito larvae to the point where they are again susceptible to the insecticide.

The benefits derived from the control of mosquitos through the application of insecticides cannot be ignored. However, their use has often produced unexpected and undesirable consequences, such as the development of resistance, destruction of desirable forms of life, and creation of residue hazards on certain crops in which mosquitos breed.

Biological control is often slow in action, frequently not entirely effective, and in many cases difficult to manipulate.

Although many problems undoubtedly lie ahead in attempting to incorporate the desirable features from each type of control into integrated programmes, the benefits derived will undoubtedly surpass anything that either approach alone can offer.

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