PAPERS AND PROCEEDINGS OF THE 27th ANNUAL MEETING

of the

AMERICAN MOSQUITO CONTROL ASSOCIATION

Host and Co-sponsor

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Part I

OUR VANISHING WEAPONS

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The American Mosquito Control Association is unique among professional societies. This uniqueness stems from the fact that the Society has members with such diverse interests. We have mosquito taxonomists, physiologists, geneticists, insecticide specialists, chemists, engineers, political representatives, medical specialists, epidemiologists, and ecologists, and many others. Their common bond is their interest in pursuing their particular specialty as it relates to mosquitoes. This is completely logical since there is probably no other single family of insects which has greater impact on man and animals than the Culicidae. If this body of specialists by analogy could be considered as an ecological food chain pyramid, then at the apex and completely relying on them, is the mosquito control specialist. Without the technical foundation provided by all of these disciplines, practical mosquito control would be out of the question. However, the mosquito control specialist must meld this technical control information into a working organization made up of trained control technicians properly equipped, adequately financed, supervised by political representatives and acceptable to the public at large. It is not surprising that ulcers are an occupational hazard among this group.

In addition to the diversity of talent in this Association, its geographical distribution is also of interest. In some respects the name, American Mosquito Control Association, is a misnomer since we have members in 86 countries and territories all around the world. Over 25 percent of the copies of *Mosquito News* are sent to countries outside of North America. Intensive efforts are being made to welcome new members within as well as outside of North America into our Association.

Since I am engaged in mosquito control activities, as are the majority of our members, my further remarks will deal mainly with the state of that art and on some of the problems facing us in this area.

A mosquito control practitioner could also be known as an applied ecologist since in essence he is attempting to eliminate or suppress one or several species of mosquitoes out of a complex of animal species. This is a very difficult task, partly because mosquitoes have been adapting themselves

[1] Presidential address, 27th annual meeting of AMCA.

to their environment throughout the geological ages in an eminently successful manner. The success of this adaptation is manifested by their ability to exploit so many aquatic niches. They can and do achieve large population numbers in spite of attack by many natural predators and parasites. Mosquitoes have very successfully exploited artificial niches created or provided by man. Some species have gained virtually world-wide distribution by occupying drinking water casks in sailing vessels and probably even exploited the clay water-containing amphorae of ancient Greeks and Phoenicians on board their vessels.

Currently, long range dispersion is being provided adult mosquitoes in aircraft harborages and we can look to new distribution records as a result. Many species have been highly successful in adapting to irrigation practices in many parts of the world. Areas where this agricultural technique is on the increase can look to further associated mosquito problems. The increasing pollution burden in many natural bodies of water and in sewage lagoons has stimulated the adaptation of a number of species of mosquitoes to these conditions. Some more subtle changes are occurring at the present time. *Aedes* mosquitoes lay their eggs along the margins of depressions or containers which are subject to later flooding. During the past two decades there has been a tremendous increase in the construction of inter- and intra-state highways and the paving of vast areas of surburban streets and parking lots. Intense run-off follows even modest rainfalls and adjoining drainage ditches, catchments, and drainage sumps have become very prolific producers of mosquitoes under these circumstances.

The ability of many species of mosquitoes to develop tolerance to chemical toxicants is too well known to bear much repetition. Because of this innate genetic flexibility, we can expect many more species to develop tolerance as exposure time to toxicants is increased. Perhaps also, some increased tolerance to adverse physical factors may be forthcoming.

It would be redundant to restate to this assembly the many types of mosquito control measures which are currently available to mosquito control workers. In recent years it has become fashionable to use the term "integrated control" implying techniques which would control an insect but not harm the environment. "Integrated control" is simply the imposition of several control measures against an insect, either simultaneously or in sequence and preferably of different types such as chemical, physical, and biological. This is really old stuff to most mosquito control districts since they have been practicing it for many years. The most recent emphasis, however, is on the biological factors, with the strict environmentalist implying that these factors would have the least deleterious effect on the environment. This is not necessarily true.

Marshal Laird, of the Memorial University of Newfoundland, stated in a recent comprehensive paper on the integrated control of mosquitos, that "We still lack a single technique involving a biotic agent commercially available in a standardized formulation when properly cleared for field use by agricultural and health authorities, which will give a predictable level of control against even one specific mosquito vector." With only a few exceptions it can safely be stated that effective, economical mosquito control must rely on insecticides. We all would prefer biological control of mosquitos in place of insecticides but with the exception of a few species of mosquito-eating fish, such controls are simply not available.

However, it is gratifying to note that intensive research is being carried out on many aspects of biological control and it is hoped that in the future practical utilization of these techniques will be possible. Much research of this type is being reported on at this meeting. The time proven physical techniques of site elimination by drainage and filling, site modification, water management, impoundment, and change in salinity are still highly effective but cannot be used in all situations and are expensive. Research on the genetics of

mosquitos and in particular the manipulation of their chromosomes and genes to introduce lethality or sterility promises to be a powerful control tool in the future. This research should be aggressively supported. Limited field trials with the male sterile technique in mosquitoes have not been as successful as with some other insects, at least as yet. One of the problems which will have to be solved in rearing large numbers of certain species of mosquitos for these purposes is to obtain mating in confined spaces.

In this country the use of chlorinated hydrocarbon insecticides, particularly DDT, for mosquito control has virtually ceased. However it is absolutely essential that DDT be retained for use in malaria control in developing countries. There simply is no acceptable, economical substitute for DDT under these conditions and its banning would be a disaster of incalculable proportions. There is great concern in international quarters that the anti-DDT hysteria in this country may cause ill advised elimination of its use in malarious countries as well. The banning of DDT in this country has taken away the pre-hatch application tool and residual adulticiding tool from our grasp. However, it is hoped that the very active research now being carried on with controlled release formulations will hopefully fulfill at least one of these losses. The more frequent application of non-persistent adulticides has not and will not fulfill the former function of DDT as a residual adulticide. However, the public attitude against DDT has reached such proportions that it is very doubtful if its use in this manner will ever be permitted again.

Concern with pollution of the environment has stimulated virtually every State Legislature and the Congress to adopt or consider adopting legislation to mitigate or eliminate such pollution. Since insecticides have often been classified as pollutants it is not surprising that these chemicals have been singled out for particular legislative emphasis. Proposals have taken the form of licensing dealers and applicators, outright banning of certain classes of compounds, restricted use lists, prescription purchasing, and many others. Very likely there will be additional restrictions placed on the manufacture, sale and uses of agricultural chemicals. The costs and time required for a company to bring a compound from the laboratory to registered status have skyrocketed. These trends have already led several prominent companies to cease developmental work on new compounds precisely at a time when new materials with specific desirable characteristics are needed. This situation is particularly critical in those areas where virtually all of the mosquitoes are resistant to the toxicants now available. At this time one can only be pessimistic about this trend being reversed in the near future.

Some of the new legislation which has either been proposed or has been adopted in some states could be extremely far reaching in its effect on mosquito control programs. Whereas customary jurisprudence presumes that a person is innocent until proven guilty, a new concept reverses this process. Such laws enable any individual to seek a court injunction to prevent the pollution of the environment even if such alleged pollution has not yet occurred. This injunction and court action would require the defendant to prove that he is not causing the damage or would not cause damage by following the proposed course of action. In other words, he is being asked to prove the negative. It would be possible to show that the use of certain levels of insecticide would not cause harm to some organisms. But below the no effect level the chemical may still be present. From the ultimate standpoint, it is impossible to prove that no harm is or could be done. Analytical techniques are now capable of identifying chemicals down to the parts per trillion level. This type of legislation may force the courts to establish pollution standards rather than scientists knowledgeable in this field. Mosquito control districts could be subject to such injunctions brought on by militant but ill informed environmentalists. It would be incumbent on mosquito control agencies, if they have not already done so,

to become involved with testifying against this type of legislation. If we do not present our side of the story we may find ourselves with our most vital tools taken away from us.

In any community where mosquitoes are a pest or health problem and a control program is established, the control agency is likely to be one of the largest local users of insecticides. Anti-pesticide propaganda has been so pervasive and intensive that a substantial segment of the public believes that all pesticides are bad. The local control agency is thus cast in a villain's role in their eyes. In truth, mosquito control agencies are just as concerned in maintaining a quality environment as are the vociferous newcomers to this field. Witness alone, the many papers and panels on ecology in this program. It behooves mosquito control agencies to improve their public relations activities and tell the true story to the public. We have been telling our story poorly or not at all. Our young people in particular, are knowledgeable about environmental matters to a surprising degree but their strong negative bias toward insecticides reflects deficient and inaccurate training.

In conclusion, mosquito control in the hands of professional entomologists and engineers who know the advantages and limitations of all their control tools, can provide a high degree of mosquito suppression without attendant environmental hazards.

ADMINISTRATIVE AND OPERATIONAL PHASES OF THE MOSQUITO CONTROL PROGRAM[1]

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It was the objective of the panel assembled to explore the functions and responsibilities of administration in the operational phases of the mosquito control program.

The basic functions of mosquito control administration were clearly set forth, which included organization under the provisions of law and operation in accordance with related laws, particularly those relating to the expenditure of public funds. The subject of "conflict of interest," relating both to elected or appointed board members and employees, was of particular audience concern.

The section addressed to "Budget Planning and Control" was worthy of separate publication for this was described as the "most important operational tool." (See Editorial Section--Ed.) Budget-making procedures were described; work plans and their development from annual to monthly control guides were discussed; and the importance of fiscal knowledge and controls for the successful management of the prorgam were stressed.

The evaluation of the control program was discussed from the administrative standpoint, describing all the common entomological and economic methods commonly employed. A new, fresh approach was added, namely, the evaluation of the superintendent or director often reflects the true evaluation of the program itself. The arguments presented were both meaningful and persuasive.

The use of public relations in mosquito control was described as "insurance for

[1] Summary of the presentations of a panel consisting of G. C. McFarland; A. W. Buzicky; R. E. Dorer; G. M. Stokes; R. Ostergaard; J. H. Kimball; G. T. Carmichael; Jay E. Graham; R. L. Vannote, Moderator.