

PAPERS AND PROCEEDINGS OF THE 32nd ANNUAL MEETING

of the

AMERICAN MOSQUITO CONTROL ASSOCIATION

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This meeting was dedicated to the memory of two distinguished past presidents of the Association, ROBERT L. VANNOTE and DON M. REES.

PRESIDENTIAL ADDRESS

BIOLOGICAL CONTROL AGENTS OF MOSQUITOES

H. C. CHAPMAN

I have been involved in mosquito research for 25 years with the last 14 years being closely associated with studies in the area of biological control. Since 1965, our Gulf Coast Mosquito Research Laboratory in Lake Charles, Louisiana, has been investigating pathogens and parasites as biological agents of mosquitoes and has particularly pioneered research on nematodes and viruses. All of this brings us to the topic of my talk which is biological control agents of mosquitoes, specifically their present status, future potential in mosquito control programs, and other inherent problems.

There is a misconception, gaining more and more popularity, that biological control agents or techniques are now operational and ready to take the place of chemical pesticides. Though nothing is further from the truth, mosquito control directors and administrators are being increasingly pressured to rid their programs of the chemicals and to use those "environmentally safe biological agents." Who is responsible for this erroneous information? I believe that much of the blame can be placed on news or press releases and on articles written by reporters following interviews of scientists. Press releases are

gaining popularity as a tool to extol and justify the use of public funds for research by publicity departments of many agencies. Such initial releases are often quite accurate but the article then loses its identity by the time it is picked up and used by other newspapers across the country. Some of these problems could be allayed if the scientist had the opportunity to proof read the article or news stories prior to publication. Spectacular headlines are the vogue. It is fashionable to decry the use of chemical pesticides and most headlines state that the new biological control agent means the end of mosquitoes. Examples: "Bacteria held mosquito control key," "Mosquito control discovered—harmless bacteria," "Worm nips mosquito," "Double barreled blast at mosquitoes." It is no wonder that the uninformed public becomes misinformed. Unfortunately even a few so-called scientists, seeking publicity or personal gain, have also provided the news media with misinformation concerning biological control.

How do you in mosquito control combat this? I believe the responsible leaders of mosquito control agencies must keep abreast of the current status in the devel-

opment of biological control agents. They should be aware of the advantages and disadvantages of using biological control agents. They should know and appreciate the present benefits that they are receiving from biological control, particularly in semi-permanent and permanent water habitats. Some published reports have shown mortalities of mosquito populations as high as 95% in such habitats, principally attributed to natural and biological control causes. It should be stressed that this information applied only to some limited habitats and not to a large mosquito producing area. It is not too soon for districts to begin developing some expertise in finding what biological agents they have and what these agents are doing to their mosquitoes.

Many mosquito control agencies have been and are presently using fish directly or indirectly to suppress mosquito populations. Some other control agencies are involved with preliminary studies with various predators; even a few are involved with pathogens and parasites. Certainly an excellent ploy to counteract the vociferous critics of chemical pesticides or vocal proponents of biological control is to show your critics some involvement in this area of biological control.

What is a fair assessment of the present status of biological agents? There has been a considerable increase in research on biological control of mosquitoes these past few years. Of particular importance, is that these investigations are encompassing a much wider variety of potential biological control agents. Research is being emphasized on predators such as fishes, notonectids, hydra, planaria, and predacious mosquitoes. Also investigators are especially pursuing research on various fungi (*Coelomomyces*, *Lagenidium*, *Metarrhizium*), a protozoan (*Nosema algerae*), several species of bacteria, principally strains of *Bacillus sphaericus*, and several mermithid nematodes, particularly *Reesimermis nielsenii*. Of this number of agents, at this point in time, only a few fishes can be called operational. Mer-

mithid nematodes according to EPA are exempt from the FIFRA regulations and therefore apparently only need to satisfy the quality and efficacy requirements of the appropriate agency prior to marketing. Many of the remaining agents lack safety testing, some need improved formulations and mass production techniques, and most are very deficient in efficacy data, to be derived from field releases.

WHO has for many years been the stimulus for biological control endeavors in mosquitoes. Until just recently, each researcher has been attempting to carry his particular biological agent through the various testing stages into eventual fruition, which is field testing, with no overall central coordination. WHO has now developed a scheme, a flow chart, in which the various biological agents progress to field testing in well defined steps. Such a program should quickly determine which are the most promising agents, define where they are in the testing scheme, and then concentrate on moving the agents through the remaining stages to the final large scale field tests. Certainly this should speed up the time schedule for making some of these agents available and operational.

Many of you may be wondering why biological control is not further along than I have stated. I believe the principal reason is the paucity of funding that has been available. About 8 years ago, I figured that in this country and Canada, less than a dozen full time scientists were working on all pathogens and parasites of mosquitoes. Compare this with the cost of bringing just one chemical pesticide to the consumer (\$5 million in the past, and the figure now probably is \$10-15 million). Also the lack of a well coordinated and concentrated effort has influenced the slow development of such programs.

What does the future hold in store for biological control agents of mosquitoes? First, everyone must realize that the biological agents are not panaceas. They are living organisms with varying degrees of

specificity to both hosts and habitats and cannot be forced into unfavorable hosts or habitats. However, once in suitable hosts and habitats, many biological agents become established and provide some to adequate control of future mosquito broods. Most biological agents (pathogens and parasites) are specific to mosquitoes and occur naturally in the environment; hence treatments of the agents should not disrupt any natural control from indigenous biological agents nor should these agents pollute the environment. Let's not fool ourselves into thinking that mosquitoes cannot eventually develop some resistance to parasites and pathogens. Since such resistance has not been demonstrated in the field, it is safe to assume that it will develop much more slowly than with chemical pesticides.

We have lost our organochlorine compounds and now only carbamates, organophosphorous, pyrethroid, and IGR compounds remain. It should be evident that our arsenal of chemical pesticides will continue to erode because of pressures from

government agencies and efforts of various vocal groups and individuals. The increased costs and unknown allowable use span will surely reduce the numbers of new chemical pesticides produced by industry. Furthermore, unless we can resolve our problems in obtaining permits from governmental agencies and also in gaining entry and conducting needed studies on private properties with minimal danger of lawsuits, we will have lost the tremendous permanent benefits gained from our source reduction programs. All of this coupled with increasing resistance problems indicates to me that we must plan to integrate biological agents into organized mosquito control programs as soon as they become available.

It is my fond hope that some day we will have many biological agents that can be used against most of the important mosquito species. Aladdin's lamp won't do it. It will require the concentrated and coordinated efforts of many diligent and perceptive scientists with very reasonable budgets.