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# VECTOR CONTROL WITHOUT CHEMICALS: A PUBLIC HEALTH PERSPECTIVE

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ABSTRACT. A public health perspective of vector control without pesticides discusses 2 scenarios, one where vector-borne disease is present and one where vector-borne disease is absent. The conclusion is that in situations where disease is present, particularly in epidemics, pesticides are necessary and there will be a requirement for pesticides into the future. Where disease is not present, nonchemical means of vector control may be a viable option.

## INTRODUCTION

If one is to consider the public health perspective of vector control without chemicals and the implications of such a strategy, one must consider 2 scenarios. First, there is vector control where a disease is present, and second, there is vector control where there is no disease.

## CONTROL OF DISEASE VECTORS

Let us take a look at the first perspective: vector control where a disease is present. This means that we have vectors, such as mosquitoes, transmitting diseases to humans or to reservoir hosts. This may be an endemic or epidemic occurrence. Our response to each type of occurrence will be different.

An epidemic requires immediate action to control the infected vector and prevent further transmission. The immediate action usually calls for chemical control of the vector in order to break the chain of infection. Historically, there are many examples where chemical control of vectors successfully ended an epidemic, which include: 1) the use of DDT dust to control body lice on refugees during World War II and thus end the transmission of epidemic typhus (Matheson 1950), and 2) insecticide spraying on the ground and by aircraft for controlling mosquito-borne encephalitis outbreaks in the USA (Fernald 1963). Could these outbreaks of typhus and encephalitis have been controlled without chemicals? In the case of typhus, in the wartime situation, it is unlikely that any other approach to control would have been effective. It is also doubtful that in the short term a more effective means of control other than chemical control of infected adult mosquitoes could have ended the St. Louis encephalitis outbreaks that have occurred in various parts of the USA since the late 1950s. However, in the 1990 St. Louis encephalitic outbreak in Florida, a public information campaign aimed at the people living in the areas where human encephalitis cases were occurring was very effective in reducing the number of cases (Meehan et al. 1991). The endemic disease scenario is entirely different from the epidemic one, mainly because there is no sense of urgency, as numerous cases are not occurring in a short period of time. This allows for a more deliberate and, one would hope, a longer lasting approach to control and in most cases gives one more options to consider. Malaria is a disease that fits this scenario. Before DDT became available in the 1940s, malaria control in the United States was mostly nonchemical, with the exception of Paris green and petroleum-based larvicides. The approach was source reduction and mechanical exclusion. Breeding areas were drained or filled and screen doors and windows were fitted to homes to exclude the vector. This program greatly reduced the number of malaria cases.

In the USA and a few other countries, malaria was successfully eradicated, and in other countries (e.g., India), brought under control by the residual spraying of DDT inside dwellings in malarious areas, a good example of effective chemical control of a vector. However, due to various problems including insecticide resistance in the vectors, we now see this approach failing; in fact insecticide resistance coupled with drug resistance in the malaria parasite compounds the difficulty of controlling this disease. It is apparent that unless more effective chemicals are found, chemical control alone is doomed to failure, at least the traditional residual spraying of dwellings is doomed (Baker 1992).

If we accept that microbials (e.g., *B.t.i.*) and the insect growth regulators are nonchemical, and we accept that source reduction may be a viable option in countries that have endemic malaria, then the possibility exists for control of vectors without chemicals. However, there is possibility and there is reality. The reality is that there is a lack of financial resources, technical expertise, and political will to carry out a nonchemical approach to malaria control in most malarious areas of the world. This is why the development of a malaria vaccine has such a high priority in the World Health Organization (Pan American Health Organization 1994).

## CONTROL OF VECTORS–WITHOUT DISEASE

The second perspective, the control of vectors without the presence of disease, provides more opportunities for controlling vectors without chemicals because there is no need to kill infected vectors, but instead the aim is to prevent production of sufficient numbers of vector mosquitoes that are capable of transmitting disease to humans. In mosquito control the most efficient methods for accomplishing this aim are by source reduction and/or larviciding. The use of insect growth regulators or microbial larvicides would allow for vector control without chemicals. Programs that are strictly larviciding or water management programs, such as many of those programs conducted in California and other western states, where most of the breeding areas are manmade, can and do conduct vector control without chemicals.

In the eastern USA, however, the situation is quite different and breeding areas are primarily natural habitats (wetlands) where water management is difficult, if not impossible, due to environmental constraints. Larviciding, although certainly an option that is used, is not always effective because areas are too vast or inaccessible except by aircraft. The vector control program is left with no alternative than to use chemical adulticides to reduce the adult populations of mosquitoes.

So what is the answer to the premise of this meeting? Can vector control be conducted without chemicals?

I believe I have indicated that this may be possible. However, in epidemic situations and even in many nonepidemic ones, the control of vectors will depend on the use of chemicals for quick, or complete, results. I see no effective short-term alternative at this time. Our dependence on chemical control will remain with us for the foreseeable future.

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