

breeding sites on your property and reporting suspected breeding sites in your neighborhood. Several excellent, environmentally friendly methods can be used to treat mosquito breeding sites without increasing the risk of resistance.

Researchers don't yet know whether individual homeowners making routine insecticide applications will have a significant impact on mosquito resistance to insecticides. With this in mind, it makes sense to limit backyard use of mosquito fogs and sprays to times when they are most needed. Insecticide use should be based on need and should be limited to times of day (early morning and late evening) when pest mosquitoes are active.

If it seems like your community sprays for mosquitoes less often than in the past, concerns about mosquito insecticide resistance may be part of the reason. For more information about integrated mosquito management, see the brochure "The Best Way to Control Mosquitoes: Integrated Mosquito Management Explained."

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## Avoiding the Super Mosquito

### *What you need to know about insecticide resistance in mosquitoes*

Most of us have heard stories of "superbugs"—almost impossible-to-kill insects that are resistant to most insecticides. The idea of insecticide-resistant mosquitoes is especially alarming. When mosquitoes become resistant to insecticides, controlling them and the diseases they carry can be a challenge.



Since the first discovery of mosquito insecticide resistance in 1947, more than 100 mosquito species around the world have shown some resistance to at least one insecticide. How we work to prevent mosquitoes from developing resistance and what you can do to help are the subjects of this publication.

### **Why should I be concerned?**

We all should be concerned about the risk of insecticide resistance in mosquitoes because resistance can reduce the effectiveness of our citywide and backyard control efforts and can increase the cost of mosquito control. When insects become resistant to one class of insecticide it may become necessary to use a different product that is more expensive or carries greater environmental risks. Insecticide resistance is especially serious when it happens among insects like mosquitoes that carry human diseases.

### **How does resistance occur?**

Some people are under the impression that insecticides cause individual insects to mutate into “superbugs.” Individual insects, however, do not develop resistance to insecticides; insect populations become resistant to insecticides. What’s the difference? To understand this, one must first understand what a population is. A population is the collection of all organisms of the same species that lives in an area where they can commonly mix and interbreed. A mosquito population may be all the

mosquitoes of a given species living in a swamp, a neighborhood, a town or a larger geographical area.

In any population it is common to have a few individuals that are naturally harder to kill with a given insecticide. These insecticide-tolerant individuals are usually quite rare at first. But when a population is widely exposed to the insecticide, the odds of survival for tolerant insects go up significantly compared to their insecticide-susceptible brethren. In this way, through natural selection over time, more and more of the population is likely to consist of insecticide-tolerant individuals. When a population requires 10 times more insecticide to be killed than when it was first exposed, we refer to that population as being insecticide-resistant.

Two factors work together to increase the chance of an insect population becoming resistant to pesticides. First, risk of developing resistance is much greater when most of the population is exposed to the insecticide. If only a small part of the insect population is exposed to the insecticide, insecticide-tolerant individuals breed mostly with susceptible individuals, reducing their chance to become dominant. Second, risk of resistance is also much greater when an insect species breeds quickly. A type of aphid, for example, that goes through 10 generations a year is more likely to develop resistance than a type of moth that may have only one or two generations a year.

### **What can be done about resistance?**

The risk of mosquito insecticide resistance can be controlled with careful planning. The surest way to slow or prevent the development of resistance is to restrict the use of insecticides to times of greatest need. Another tactic is to rotate among different types of insecticides. Because of the limited number of safe and affordable insecticides for mosquito control, most communities and health departments choose to manage



resistance by limiting their use of insecticides to essential situations. Some of the tactics that professionals

use to reduce the need for areawide mosquito spraying include identifying and eliminating mosquito breeding sites; careful surveillance; and careful timing and targeting of mosquito spraying operations.

You can help your community slow resistance by eliminating mosquito

