



Mosquito Megabites: Effective Mosquito Control

by Philip Dickey



Less than one percent of those who become infected by the West Nile virus will develop severe illness. Those over age 50 have the highest risk of severe health effects.

Since its first documentation in the United States in 1999, West Nile (WN) virus has spread steadily across the country, reaching the West Coast in 2002. Extensive newsmedia coverage has fanned the natural sense of dread, compounded by feelings of helplessness that result from not knowing what can be done. Unfortunately, some columnists have exploited these fears to call for the return of DDT, the persistent insecticide banned in the United States in 1974 because of its devastating environmental impacts. When considering the diseases spread by mosquitoes and the control methods available, it is critical to rely on facts rather than fear. Otherwise, control methods will not only be unnecessarily risky but also ineffective. Effective mosquito control should be community based, but individuals play a very important role.

West Nile Virus in Perspective

Commonly found in Africa, West Asia, and the Middle East, the WN virus responsible for the illness is now firmly established in the Western Hemisphere. Through the end of 2002, animal infections had been seen in 44 states and human cases in 40. There have been 3852 documented cases of infection so far, with 241 deaths. In contrast, 36,000 Americans die each year from flu-related complications. According to the Centers for Disease Control and Prevention (CDC), "most people who become infected with West Nile virus will have either no symptoms or only mild ones (e.g. West Nile fever). However, on rare occasions, West Nile virus infection can result in severe and sometimes fatal illnesses. There is no evidence to suggest that West Nile virus can be spread from person to person or from animal to person." CDC says that the greatest risk of serious symptoms is for people over the age of 50, and those with compromised immune systems may also be at increased risk.

WN virus is transmitted to humans by several species of mosquitoes. It is spread largely by birds, which are infected by mosquitoes and then pass the virus on to other mosquitoes that bite them. Humans cannot catch the virus from birds, only from mosquitoes. Some readers may be concerned about pets and farm animals. Horses, mules, donkeys and other equines are more susceptible than other animals. Most horses do not become ill and show no symptoms at all, but about one-third of horses that become ill die. A vaccine is available to protect horses, but it requires several months to become effective. Consult your veterinarian for more information.

Even though most people who are bitten by infected mosquitoes will not suffer serious illness, the disease is an emerging public health problem in the United States. WN virus highlights the need for effective mosquito management programs and responsible public education. It does not, however, call for widespread mosquito eradication, a strategy that would be both impractical and even ecologically damaging. The CDC states that "the application of chemicals to kill adult mosquitoes by ground or aerial applications is usually the least efficient mosquito control technique."

Mosquito Biology Primer

There are about 160 species of mosquitoes in the United States, the most important belonging to the genera *Culex*, *Aedes*, *Culiseta*, *Ochlerotatus*, and *Anopheles*. Of the 45 mosquito species found in Washington, only a few spread the West Nile virus. Despite differences in their habitat preferences, most develop in water that is standing or very slow moving. This means that control of the larval stages can center on just these breeding sites.

Mosquitoes pass through four basic stages: egg, larva, pupa, and adult. Female adults lay eggs on the surface of or near still water, and the larvae and pupae develop in the water. The time period from egg laying to hatching of adults varies with temperature and species from about four days to four weeks. (*Aedes* mosquitoes lay their eggs on moist soil that is periodically flooded, and but if the eggs remain dry, they can survive for months or longer.) Only adult females bite humans to obtain blood. Mosquito activity varies considerably by location and also seasonally. Although mosquitoes are more active in warmer weather, beginning in spring, it is still important to control breeding sites in the winter in places like western Washington where it rains during that season, and in warm winters some species may be active. Even if mosquitoes are not active at that time, the larvae may survive in standing water.

Although the appearance of mosquitoes is well known, they are often confused with similar-looking insects that fly around the yard or are attracted to porch lights. Fungus gnats, certain midges, and crane flies resemble mosquitoes but do not bite humans. That's fortunate, because if crane flies did bite, they'd probably leave a lump the size of a fried egg.

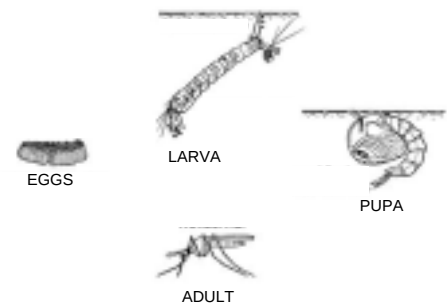
Mosquitoes play an important role in wilderness ecosystems, where they provide food for a wide range of aquatic organisms, including fish and dragonflies. That's why elimination in all areas is not an option. Control for public health protection needs to be focused on where it will do the most good and the least harm. The most effective management methods focus on the mosquito larvae because their habitat is localized and because larva control gets them before they can start biting.

Physical/Cultural Controls

If mosquitoes are biting you indoors, install or repair window screens as a first step. Any insects that are spotted can be quickly dispensed by using a fly swatter. If your problems are in the yard, appropriate clothing combined with use of repellants can help, and you should also look for breeding sites. As an individual, you can make the biggest contribution to community mosquito control by eliminating breeding habitat on your property. Since most mosquitoes don't fly very far, those that bite you at home originated nearby, perhaps on your property. A list of potential breeding sources is shown at the right. City dwellers will have the easiest time in addressing these sources of standing water. Rural inhabitants should begin at the house and work outwards as time and resources allow, with priority given to larger water areas.

Take a walk around outdoors after a rain and see where water is collecting. Don't ignore obvious things like standing water in tire ruts. Completely unnecessary sources of water, such as clogged roof gutters, should be eliminated. Useful or decorative water features such as bird baths and fountains can stay; you just need to change the water once or twice a week.

A variety of mosquito traps are now on the market. The electric insect "zappers" will kill a few mosquitoes and many beneficial insects. Other traps use a light source or a chemical to attract mosquitoes. All of these devices will catch or kill measurable numbers of mosquitoes, but whether or not they will significantly reduce the population in a given situation depends on many things. Scientific data on the effectiveness of these devices is scarce, and some companies may overstate claims. Be a smart consumer and research any claims as much as possible. Most importantly, don't rely on traps to do the job and don't neglect the removal of breeding sites.



The most effective control methods focus on mosquito larvae rather than adult mosquitos. Elimination or management of breeding sites (see list below) is where to begin.



Common Household Mosquito Breeding Sites

- Birdbaths
- Cans, jars, and containers
- Clogged roof gutters or drains
- Dripping faucets
- Flat roofs
- Hot tub or pool covers
- Old tires
- Fountains (if turned off)
- Ponds
- Plastic wading pools
- Rain barrels
- Recycling bins
- Saucers under potted plants
- Stumps and tree holes
- Sumps and drains
- Toys (e.g. wagons) in yard
- Watering cans, buckets
- Wheelbarrows or carts



Home Mosquito Control

- ❖ Remove or regularly drain all water-retaining objects around the house (see list on facing page).
- ❖ Drain or repair gutters and downspouts if they retain water.
- ❖ Install screen or fine netting over top of rain barrels.
- ❖ Stock permanent ponds with mosquito-eating fish (see text at the right).
- ❖ Repair leaking water faucets.
- ❖ Install window screens.
- ❖ Burn citronella candles when needed on patio if wind is calm.
- ❖ Wear protective clothing outdoors during mosquito season.
- ❖ If possible, stay indoors at dawn and dusk when mosquitoes are most active.
- ❖ Use mosquito repellent with care if needed.

Biological Controls

One of the most effective mosquito controls for ponds or wetlands is fish. Small backyard ponds can be easily stocked with goldfish, but never introduce non-native fish species to natural bodies of water. They tend to kill native fish, either directly or by competing for food or altering the habitat in other ways. Many native and game fish are good at controlling mosquitoes. Check with your wildlife department before introducing any fish into bodies of water. A permit may be required, and they can help locate a supplier for the fish. Frogs, toads, dragonflies, hummingbirds, and bats also eat mosquitoes and should be protected.

Many community mosquito programs use *Bacillus thuringiensis israelensis* (B.t.i.), a selective insecticide derived from naturally occurring bacteria, to kill the larvae. B.t.i. has the advantages that it targets the larval stage, has relatively low toxicity to fish and many other water-dwelling creatures, and degrades quickly. Aquatic applications generally require both a pesticide applicator's license and a special permit in Washington state. An exception to this requirement has been made for the small donut-shaped Mosquito Dunks™ and even smaller Mosquito Bits,™ that float and dispense B.t.i., provided they are used as labeled for the home garden. The donuts are effective for about a month. These products should only be used in cases where the physical and biological controls described earlier are not appropriate.

Chemical Controls

Chemical control is the last resort. Most chemical control is aimed at the adult, and at that point it is too late to be very effective. Spraying indoors is futile. Most chemical controls are also highly toxic to beneficial insects, birds, and fish, including those that eat mosquitoes. The chemical adulticides most often used include organophosphates such as malathion or naled and several synthetic pyrethroids. In recent studies in King County, malathion was found in more than half of streams tested and at levels that exceed some safety standards for salmon and other fish. Most of these streams also contained several other insecticides that could act in concert with malathion to pose higher risks. All of these chemicals kill via the nervous system, a non-selective means of toxicity that can also affect humans, especially children, at high enough doses.

Insect growth regulators (IGRs such as methoprene) that affect larval development are less toxic to humans than traditional insecticides. They are toxic to aquatic invertebrates and application to water requires a permit in Washington, except for home garden use of Zodiac Preventative Mosquito Control.™

Chemical control is generally not a good option for home mosquito control but IGRs can be part of community-wide control efforts under certain circumstances.

Mosquito Repellents

There are two ways to keep mosquitoes off of your skin outdoors: wear protective clothing or use mosquito repellents. Long-sleeved shirts and pants, especially with Velcro™ closures at the ankles and wrists, are effective but uncomfortable in warm weather or when exercising. That's why most people pour on the Off,™ although clothing made of mosquito netting is available from outdoor stores. The most popular and effective repellent is DEET (N, N-diethyl-meta-toluamide), an ingredient with a generally good safety record, but which has been responsible for some documented seizures and deaths, particularly among children who were apparently susceptible or heavily treated. If you use DEET, choose the product with the lowest percent of active ingredient that gives satisfactory results. Generally speaking, the more DEET in a product, the more long lasting the protection, but studies show at above 50% DEET the increased protection becomes smaller and smaller. Consumers Union (CU) recently found that a product with only 33% DEET in microencapsulated slow-release form (3M Ultrathon™) was able to give longer protection than a 100% DEET product. One way to minimize your DEET exposure is to treat your clothing rather than your skin. Never treat skin that is covered by clothing. The EPA advises great caution when treating

children, “using as little repellent as possible and washing off after use.” The American Academy of Pediatrics has recommended using only products with a low concentration of DEET, 10% or less, on children aged 2 - 12. Many experts suggest not using DEET on children under age 2.

Another effective synthetic mosquito repellent is picaradin. Although it is reported to be less irritating to the skin than DEET, similar safety precautions are advisable. Read labels for specific instructions.

Various herbal repellents based on citronella, eucalyptus, and soybean oil are available. Some of these products do not provide protection for very long without reapplication. CU found that Bite Blocker,™ a product with 2% soybean oil, gave one to four hours of protection, the best for a non-DEET product. Newer products based on lemon and eucalyptus oils (e.g. Repel™ and Off! Botanicals™) are reportedly very effective. Individual results may vary, however, and each person must decide how well a particular product works for them.

Community Mosquito Control

Every individual's mosquito control efforts are important, but citizens and communities need to work together to be more effective. Many communities have established mosquito control districts (MCDs) to monitor and control mosquitoes, often achieving excellent results while eliminating 90% of adult insecticide sprays. It is important that MCDs engage in extensive monitoring and integrated control methods, rather than existing merely to facilitate the spraying of adulticides. The box at the right lists some things you can do in your community to help control mosquitoes and prevent the spread of West Nile virus. For more information on community mosquito control, please contact our office. ■

Community Mosquito Control

- ❖ Contact your city or county to see what their mosquito control plan looks like.
- ❖ Be sure the plan includes education, monitoring, and breeding control, not merely insecticide spraying.
- ❖ Talk to your neighbors about breeding sites on their property.
- ❖ Find out if your community has mosquito management activities that you can participate in.

Disposal of Pesticides

If you have pesticides, including insect sprays or mosquito repellent, that you no longer intend to use, they should be taken to a household hazardous waste collection site. These containers should not be put in the trash unless empty. Statewide in Washington, call the Department of Ecology's toll-free number 1-800-RECYCLE or your local health department or solid waste agency for instructions. In Seattle or King County call the Health Department's Hazards Line at 206-296-4692 or 888-TOXIC-ED.

For More Information

Centers for Disease Control and Prevention, West Nile Virus Home Page, www.cdc.gov/ncidod/dvbid/westnile/index.htm

Washington State Department of Health, West Nile Virus website, www.doh.wa.gov/ehp/ts/Zoo/WNV/WNV.html

Northwest Coalition for Alternatives to Pesticides fact sheets:

Managing Mosquitoes without Pesticides, www.pesticide.org/mosquitoes1.pdf

Community Mosquito Control, www.pesticide.org/mosquitoes2.pdf

Protection from Mosquito Bites, www.pesticide.org/mosquitoes3.pdf

Plant-based Mosquito Repellents: Making a Careful Choice, www.beyondpesticides.org/mosquito/documents/NCAPrepellents.pdf

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