

Repellent Wars

There are many landmarks that tell us we are approaching the dog days of summer. Sirius rises and sets with the sun. We're already to the "Es" in the hurricane alphabet. The kids are out of school and air conditioner repairmen are working 60 hour weeks. Mosquito-borne viruses are back in the headlines, and, most importantly, companies, large and small, are at war for market shares of products, they claim, will keep us free of biting arthropods and the diseases they transmit.

The choices of devices and products that claim to protect us from biting mosquitoes is truly remarkable. Every summer various forms of these products appear on supermarket and superstore shelves. We are blitzed by advertising for these products from Memorial Day through Labor Day. An annotated list of our choices appears below.

Vitamins and herbal remedies. Every year news stories appear touting the mosquito-repelling benefits of ingesting mega-doses of B vitamins, brewer's yeast, garlic, beer, whisky, cigars, and cigarettes. While some of these remedies may render the user temporarily immune to the effects of mosquito bites (alcohol) or may temporarily protect the user (and friends) from a down-wind attack (smoke) none have ever been shown in controlled scientific studies to protect users from biting insects.

Sonic devices and repellent wristbands. Every year a vast array of sonic devices appear in superstore checkout lines and high-end catalogs. Prices range from \$9.95 to \$99.95 (plus S&H). Manufacturers claim that the devices mimic a sound (dragon fly wing beat, bat vocalizations, or male mosquitoes) that the female mosquito detests, thereby scaring her away. None of the sonic devices we have tested repel mosquitoes. In fact, it is not uncommon for a female mosquito to land directly on the sonic device and attempt to probe. Likewise, repellent-impregnated (usually with DEET or citronella) wristbands are commonly found in checkout line displays. These products do not repel mosquitoes and, again, we have often observed females landing directly on the wristband while attempting to blood feed in laboratory tests.

Electronic bug zappers. These products usually contain a central UV light surrounded by an electrically-charged grid. Insects are attracted to the UV light and electrocuted when they touch the grid. These devices kill insects indiscriminately and mosquitoes and biting flies make up only a small portion of nightly kills. Beneficial insects take a particularly hard hit. To make matters worse, studies have shown that yards with bug zappers may have more biting mosquitoes than yards without zappers.

Carbon dioxide-baited traps. A large number of CO₂ baited traps are now on the market. These traps are definitely more discriminating, in terms of the number of biting flies they collected, when compared with bug zappers. Even though CO₂-baited traps collect large numbers of mosquitoes and other biting flies, they are largely untested in controlled scientific field experiments. It is unclear whether the traps attract mosquitoes into an area where humans may then provide a stronger source of attraction. In other words, will the bug zapper results showing larger numbers of mosquitoes in yards with a zapper be repeated by the CO₂ traps? Time will tell.

Larval management. It is always a good idea to monitor and control standing water around the home that may contain immature mosquitoes. In some cases this is easy, for example, flush bird baths every 10 days. In the case of ditches and small shallow ponds it is more difficult to control immature mosquitoes. Larvicidal dunks containing *Bacillus thuringiensis israelensis* (Bti), *Bacillus sphaericus*, and methoprene are readily available to homeowners to help solve mosquito breeding problems around the home.

Permethrin. Permethrin, a synthetic version of pyrethrum which is derived from chrysanthemum flowers, is an insecticide that can be used to treat clothing and netting. Biting flies are killed soon after making contact with the treated fabric. Permethrin is most commonly used by the military, hunters, campers, hikers, and fishermen. Biting insects and ticks are still attracted to treated individuals and will continue to be a source of annoyance, but they will not live to bite another day. Often, permethrin is used in combination with a personal repellent.

Botanical repellents. Essential oils can be distilled into a pure form from plants. Many essential oils have insecticidal and repellent properties. Some of the more common include oils of citronella, eucalyptus, vanilla, cedar, garlic, and penny royal. Some, especially eucalyptus and citronella have been formulated into repellents. Because these products are toxic in high concentrations, repellent formulations tend to contain small amounts (0.05 to 1.0 %) of active ingredient. Because of this, botanical repellents usually have to be reapplied frequently, sometimes as many as 6 times an hour.

N,N-diethyl-meta-toluamide (DEET)-based repellents. Aerosols, creams, and lotions containing DEET are generally considered the most effective personal insect and tick repellents. DEET is a synthetic repellent that was first isolated, identified and purified at the USDA Laboratory in Orlando during the early 1950s. Since then it has become the most popular and effective personal repellent. It has many formulations ranging from 5 to 100% active ingredient. The 100% formulation is most commonly found in specialty sporting goods stores. Application of a 5 % product will provide about 90 minutes of protection while application of a 30% formulation will protect for more than 6 hours. Within the last year the American Academy of Pediatrics has increased the recommended DEET formulation for use on children from 10 to 30 percent.

Adults and children throughout the world have two major concerns with biting insects during the summer months. First are the biting insects that are a nuisance, but do not present a direct health threat. Second, and far more important, are the biting insects and ticks that pose a direct health threat due to an allergic sensitivity to the bite and/or a pathogen that is transmitted by the bite. These pathogens include nematode worms (that cause elephantiasis and river blindness in the tropical world), protozoa (malaria), and viruses (eastern equine encephalitis, St. Louis encephalitis, and West Nile viruses to name but a few). Clearly, the stakes are much higher in situations where an insect or tick bite may result in disease. When there is low risk of disease transmission and the bites are merely a nuisance, individuals should feel free to experiment. I say that sonic watches and DEET-impregnated wristbands don't work – as our tests and those of others have shown. But it's your money and you can always try them out for yourself. My only advice: Buyer beware.

During the times we find ourselves in a true arthropod-borne disease Medical Emergency the importance of managing insect and tick bites becomes much more critical. A significant segment of the workforce including night watchmen, EMTs, fire rescue workers, and police working the night shift, are placed in situations where they cannot avoid mosquitoes from sunset to sunrise. The rest of us encounter mosquitoes during outings, cookouts, firework displays, and parking lot conversations after PTA meetings. During medical emergencies, such as the current EEE outbreak in north Florida, it is important to avoid mosquito bites. This can be done by following 3 basic and simple rules.

1. Avoid mosquitoes during their peak activity period from sunset to sunrise. Stay indoors or in areas where biting mosquitoes are at a minimum.
2. If you cannot avoid mosquitoes and have to go out, cover as much skin as possible with clothing. There are many new and extremely comfortable breathable fabrics (Gortex for one) that have been developed by the exercise industry. Many of these lightweight fabrics provide protection from mosquito bites. So if you must go out, cover up.
3. Use an insect repellent with a reasonable protection time (> 1hr per application) on all exposed skin. Reapply the repellent as needed.

Arthropod-borne disease medical emergencies have been declared more frequently throughout North America during the past 5 years. It is unlikely that this trend will change soon. Make sure to protect yourself and your children from insect and tick bites during medical emergencies by following the 3 easy steps outlined above.

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