



# Using Insect and Tick Repellents Safely



## DISEASES TRANSMITTED BY ARTHROPODS

During the summer months, arthropods, including mosquitoes and ticks, are as common as backyard picnics and swimming pools. Unfortunately, they bring with them not only the discomfort of bites, but also the possibility of transmitting human and animal diseases. Two diseases of concern, which occur in the northeastern United States, are West Nile encephalitis transmitted by mosquitoes and Lyme disease transmitted by ticks.

West Nile encephalitis was first documented in the Western Hemisphere in August 1999, when an outbreak occurred in the New York City metropolitan area. In 1999, the Centers for Disease Control and Prevention confirmed 62 human cases of West Nile encephalitis, including seven deaths, although the actual human infection rate was much higher. Infected mosquitoes transmit the West Nile virus. These mosquitoes usually bite and infect wild birds—the primary hosts of the virus—but can also infect horses and other mammals, in addition to humans. In 2000, the virus was detected in wild birds in twelve northeastern states and Washington, D.C.

Lyme disease was first identified in the United States in 1975, after a mysterious outbreak of arthritis in Lyme, Connecticut. Since then, reports of Lyme disease have increased dramatically, and the disease has become an important public health problem in some areas of the United States. Lyme disease is an infection caused by a member of the corkscrew-shaped bacteria known as

spirochetes. In the Northeast, the blacklegged tick, *Ixodes scapularis*, is most commonly associated with transmitting this disease to humans.

In addition to West Nile encephalitis, mosquitoes also can transmit dog heartworm and the Eastern Equine, Western Equine, and St. Louis Equine encephalitis virus. Besides Lyme disease, ticks can transmit Rocky Mountain Spotted Fever, tularemia, babesiosis, and ehrlichiosis. Some of these diseases are present only sporadically but when they do occur, outbreaks can be severe.

## AVOIDING CONTACT WITH MOSQUITOES AND TICKS

Mosquitoes and ticks prefer certain types of environments. By avoiding these areas or eliminating these environments from your outdoor living areas, you can reduce your chance of being bitten.

Reducing the number of mosquitoes around your home and neighborhood can be done by eliminating standing water in which mosquitoes breed. Dispose of anything outside that can hold water, such as tin cans, ceramic pots, and used tires. Drill holes in the bottoms of recycling containers left outdoors. Clean clogged roof gutters every year. Turn over plastic swimming pools/wading pools and wheelbarrows when not in use. Do not allow water to stagnate in birdbaths, ornamental pools, water gardens, and swimming pools or their covers. Alter the landscape of your property to eliminate standing water. Keep in mind that during warm weather, mosquitoes can breed in any puddle of water.

Ticks thrive in a different type of environment, mainly wooded, brushy, and grassy places. Campers, hikers, outdoor workers, and others who frequent these areas are more likely to come into contact with ticks. For homeowners, exposure to ticks is greatest in the woods and garden-fringe areas of their properties, but ticks can also be carried by animals into lawns and gardens. You can determine if you have a high tick population by sweeping or dragging your yard's vegetation with a white cloth attached to a dowel, then inspecting the cloth for ticks. Removing firewood and clearing leaves, brush, and tall grass from around houses and at the edges of gardens can reduce the number of ticks by reducing the number of rodents present.

Although we can avoid or try to eliminate environments where insects and ticks live, we cannot totally eliminate our exposure to these pests. However, we can use insect repellents to make ourselves less attractive to insects and ticks.

## WHAT ARE REPELLENTS?

Repellents are chemicals applied to exposed skin or clothing that can provide some relief and protection from mosquitoes, ticks, and other biting pests. Repellents containing the active ingredient N,N-diethyl-meta-toluamide (N,N-diethyl-3-methylbenzamide)—better known as DEET—are effective in repelling mosquitoes, biting flies, chiggers, fleas, and ticks. DEET has been available to the general public since 1957. According to the EPA, DEET is used annually by almost 40 percent of Americans and by about 200 million people worldwide.

## CHOOSING AN APPROPRIATE CONCENTRATION OF DEET

A variety of products containing DEET (lotions, creams, gels, aerosols, pump sprays, and impregnated towelettes) can be purchased in concentrations ranging from 4 to 100 percent. For most adults, products containing 10 to 35 percent DEET will provide adequate protection under most conditions. The American Academy of Pediatrics does, however, recommend that repellents used on children contain no more than 10 percent DEET.

Products containing a higher concentration of DEET generally provide longer-lasting protection. These products are more suitable when mosquitoes and other pests are present in large numbers and when conditions lead to rapid loss of repellent from the skin—for instance, when the temperature and humidity are high causing significant perspiration.

However, people do differ in how attractive they are to mosquitoes, so the efficacy of a repellent varies among people. Usually, repellents remain effective for one to five hours, the length of time depending on several factors, including the degree to which a person has perspired, the extent to which a person has rubbed his or her skin, and the amount of repellent that has been applied. Nevertheless, it is wise to use the lowest concentration of DEET that you have found to be personally effective. *To use a repellent safely, you must use it properly.* Read the product's label and follow all directions.

**TO USE A REPELLENT SAFELY, YOU MUST USE IT PROPERLY.**

## IS DEET SAFE?

Having been in use for more than 40 years, DEET has a remarkable safety record. However, as with all products used against insects and related pests, concerns have been raised about DEET. Laboratory testing has shown that DEET is absorbed through the skin, but once in the body, it is readily eliminated in the urine, with the highest urinary concentrations occurring several hours after application. Studies on both animals and people indicate that DEET does not accumulate in the body. Cases of illness caused by DEET have been reported in the medical literature, but in most of these cases, DEET was used inappropriately, excessively, or repeatedly over a long period.

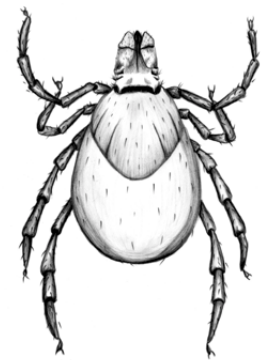
## GUIDELINES FOR SAFE APPLICATION

Follow these guidelines when using insect repellents containing DEET, especially when applying them to children.

- Verify that the product has an EPA registration number; its presence on the label means the product was approved for use by the EPA.
- Before using any product, read and understand the directions on its label.
- Do not spray a repellent in an enclosed area or near food, and do not inhale aerosol formulations.
- Repellents should not be applied to infants or used by pregnant women.
- Use just enough repellent to lightly cover exposed skin and clothing. Never apply repellents to cuts, wounds, or inflamed and irritated skin. Do not saturate the skin or apply beneath clothing.
- To apply a repellent to your face, first dispense or spray it onto your palms and next rub your hands together. Then apply a thin layer to the surface of your skin. Do not place repellent in your eyes or mouth.

- Do not allow children to apply DEET by themselves.
- Do not apply a repellent directly to a child's skin. First apply it to the palms of your own hands and then apply it to the child. Do not apply repellent to children's hands as they may touch their eyes and mouth causing irritation.
- DEET can damage plastics, synthetic fabrics, leather, and painted or varnished materials. DEET does not damage natural fibers, such as cotton or wool.
- After applying a repellent, wipe or wash it from your hands.
- A single application of a repellent is sufficient under most conditions. Avoid prolonged or excessive use of DEET.
- Once indoors, wash all treated skin and clothing with soap and water. Wash treated clothing before wearing it again.
- If you suspect that you or your child is reacting negatively to an insect repellent, discontinue its use, wash treated skin, and call the local Poison Center. If you must see a doctor, take the repellent with you, as the label will provide the doctor with additional medical information.

A very small segment of the population may be sensitive to DEET and/or other insect repellents. For more information about DEET, contact the National Pesticide Telecommunications Network at 1-800-858-7378 or visit their Web site at <http://ace.orst.edu/info/nptn/>.



66. WOODRUFF '03

## ARE THERE ALTERNATIVES TO DEET?

If you do not wish to use DEET, or if your physician advises against its use, other skin application products are available that can provide protection.

**Avon's Skin-So-Soft Bath Oil** received considerable media attention several years ago when many consumers reported it to be an effective mosquito repellent. However, various laboratory studies have shown that the original Skin-So-Soft formulation provided less than an hour of protection. Avon now sells products that contain citronella oil, an EPA-recognized insect repellent.

**Avon's Skin-So-Soft Bug Guard plus IR3535 Insect Repellent lotion with sunblock** is an effective insect repellent—in one study, this product did as well as the DEET repellents. The active ingredient in this product is ethyl butylacetylaminopropionate and its acid form.

**Bite Blocker** is a plant-based repellent consisting of soybean oil, geranium oil, and coconut oil. The results of several studies indicate that this product provides good protection for at least 3 hours.

**Citronella oil** is the active ingredient most commonly found in “natural” or “herbal” insect repellents. Citronella can be an effective repellent, but DEET provides longer protection.

**Plant-derived repellents** have not been demonstrated to have the broad and substantial efficacy of DEET—although thousands of plants have been tested as potential sources of insect repellents. A few plants whose essential oils have shown repellent activity against insects include citronella, cedar, verbena, pennyroyal, geranium, lavender, pine, cajeput, cinnamon, rosemary, basil, thyme, allspice, garlic, and peppermint. Most of these oils give short-lasting protection, generally less than 2 hours.

In addition to above-mentioned repellents that are applied to the skin, permethrin, a synthetic pyrethroid, is applied to clothing. Permethrin is a powerful, rapidly acting insecticide that kills ticks and insects that come in contact with treated clothes. It can be effective for 2 weeks or more if the clothing is not laundered. Permethrin should never be placed directly on the skin, only on clothing. Read the product label to use this insecticide safely.

Follow these guidelines when using permethrin repellents.<sup>1</sup>

- **Treat clothing only—do not apply to skin.** If you accidentally get the product on your skin, immediately wash with soap and water.
- Apply to clothing in a well-ventilated outdoor area, protected from wind.
- Only spray permethrin repellents on the outer surface of clothing and shoes before you wear them—do not apply to clothing while it is being worn.
- Only spray enough product to lightly moisten the outer surface of the fabric, causing a slight color change or darkening; do not saturate clothing. Do not exceed recommended spraying times. Pay special attention while treating socks, trouser cuffs, and shirt cuffs to ensure proper coverage.
- Hang treated clothing outdoors and allow to dry for at least 2 hours (4 hours under humid conditions) before wearing.
- Do not treat clothing more than once every 2 weeks. Launder treated clothing, separately from other clothing, at least once before retreating.
- Keep treated clothes in a separate bag.

<sup>1</sup> These recommendations were taken from the New York State Department of Health's Fact Sheet titled, “Health Advisory—Tick and Insect Repellents.”

## GENERAL PEST PREVENTION TIPS

- Make sure window and door screens are “bug tight.”
- Wear long-sleeved shirts and long pants if you must go outdoors.

## MOSQUITO PREVENTION TIPS

- Use the proper type of lighting outside: incandescent lights attract mosquitoes, while fluorescent lights neither attract or repel them.
- Mosquitoes are repelled by high winds, so electric fans may provide some relief at outdoor events.
- Stay indoors at dawn, dusk, and in the early evening, when mosquitoes are most active.
- If you must, fog with pesticides in the evening when mosquitoes are active. Follow all directions on the label.
- Vitamin B and “ultrasonic” devices have not been proven effective in preventing mosquito bites.

## TICK PREVENTION TIPS

- Avoid deer-tick-infested areas, especially in May, June, and July.
- Wear light-colored clothing so that ticks can be spotted more easily.
- Tuck pant legs into socks or boots, and shirt into pants.
- After being outdoors, remove clothing, and wash and dry it at a high temperature.
- Inspect your body carefully. Remove attached ticks with tweezers, grasping the tick as close to the skin surface as possible and pulling straight back with a slow and steady force; avoid crushing the tick's body.

## HOW TO READ AN INSECT REPELLENT LABEL

Because so many different insect repellent products are available, you might find it difficult to choose the right one for your needs. However, the product's label will provide important information about active ingredients, proper handling and application, and first aid. You should always read and understand the label before using any pesticide product. A few sections that appear on a label are described below and an imitation/fictitious label is illustrated.

The first thing you should look for on a product label is an EPA Registration Number (as indicated by the letter "A"). This number indicates that the product has been approved by the Environmental Protection Agency (EPA) for use. The product label will list the active ingredients and their concentration (indicated by the letter "B"). For DEET products, the word "DEET" will not be listed, but its chemical name "N, N-diethyl-m-toluamide" will be listed as the active ingredient. Again, the concen-

tration will help you choose appropriate products for children—which are products containing no more than 10 percent DEET.

Proper application and directions for use are also listed on the label (indicated by the letter "C"). For insect repellents, you should look to see if the product is to be applied on your skin or just on your clothing, how the product should be applied to children, and if it can be used indoors. Every label will have a Precautionary Statement, which covers first aid. This section (indicated by the letter "D") contains any possible hazards of using the product and what you should do if the product would get into your eyes or be swallowed. Also, emergency telephone numbers may be listed.

The product label provides other important information, such as what pests are repelled and manufacturer contact information. Be sure to read the entire product label, as not all labels are organized the same.

## FOR MORE INFORMATION

### National Pesticide Telecommunications Network

(800) 858-7378 and  
<http://ace.orst.edu/info/nptn/>

### Pesticides and Mosquito Control, Environmental Protection Agency

<http://www.epa.gov/pesticides/factsheets/skeeters.htm>

### Mosquitoes and Mosquito Repellents: A Clinician's Guide, *Annals of Internal Medicine*

<http://www.acponline.org/journals/annals/01jun98/mosquito.htm>

### Penn State College of Agricultural Sciences

<http://www.cas.psu.edu/>

For more information, please see the article by Mark S. Fradin, MD, "Mosquitoes and Mosquito Repellents: A Clinician's Guide" in *Annals of Internal Medicine*. June 1, 1998. 128:931-940.

Prepared by Sharon I. Gripp, database administrator/webmaster, Winand K. Hock, professor of plant pathology, and Steven B. Jacobs, senior extension associate in entomology.

Penn State College of Agricultural Sciences research, extension, and resident education programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.

This publication is available from the Publications Distribution Center, The Pennsylvania State University, 112 Agricultural Administration Building, University Park, PA 16802. For information telephone (814) 865-6713.

Where trade names appear, no discrimination is intended, and no endorsement by Penn State Cooperative Extension is implied.

Issued in furtherance of Cooperative Extension Work, Acts of Congress May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture and the Pennsylvania Legislature. T. R. Alter, Director of Cooperative Extension, The Pennsylvania State University.

This publication is available in alternative media on request.

The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. It is the policy of the University to maintain an academic and work environment free of discrimination, including harassment. The Pennsylvania State University prohibits discrimination and harassment against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, or veteran status. Discrimination or harassment against faculty, staff, or students will not be tolerated at The Pennsylvania State University. Direct all inquiries regarding the nondiscrimination policy to the Affirmative Action Director, The Pennsylvania State University, 201 Willard Building, University Park, PA 16802-2801, Tel 814-865-4700/V, 814-863-1150/TTY.

© The Pennsylvania State University 2001


CAT U0211 R15M801PS ICT4448

**Generic Pest Brand**

UNSCENTED

**NO-BITES**

INSECT REPELLENT



Protection from Mosquitoes, Ticks, Biting Flies, Gnats, No-See-Ums, Chiggers, Mites, and Fleas

**KEEP OUT OF REACH OF CHILDREN**

**CAUTION**  
Read precautions on side panel

**ACTIVE INGREDIENTS:**  
 N,N-diethyl-m-toluamide.....15.5%  
 Other Isomers.....1.5%  
 Inert Ingredients.....83.0%

Net Wt. 10 oz.

No-Bites provides hours of protection from mosquitoes and ticks. Also repels biting flies, gnats, no-see-ums, chiggers, mites, and fleas. Generic Pest Brand's unique formula is not greasy, won't stain, and has no unpleasant odor.

**READ ALL DIRECTIONS BEFORE USING THIS PRODUCT.**

**DIRECTIONS FOR USE:**

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Hold container upright 4 to 6 inches away from skin or clothing. Do not use as a space spray. Use just enough repellent to cover exposed skin. Avoid overexposure. Frequent reapplication and saturation are unnecessary. Apply on face by first spraying small amounts in palm of hand and spreading on face and neck. Do not apply to the hands of young children. Wash treated skin and clothing after returning indoors. Will not damage nylon and cotton. May damage some synthetic materials. **STORAGE:** Store away from heat or flame in an area inaccessible to children. **DISPOSAL:** Do not reuse empty container. Wrap container and put in trash.

**PRECAUTIONARY STATEMENTS:**

**HAZARDS TO HUMANS: CAUTION:** For external use only. May irritate eyes. Do not get in eyes or mouth. Harmful if swallowed. Avoid breathing spray mist or using in enclosed area. **STATEMENT OF PRACTICAL TREATMENT: If swallowed:** Call a physician or Poison Center. If on skin: May cause skin reactions in rare cases. If so, wash with soap and water. Get medical attention if irritation persists. **PHYSICAL AND CHEMICAL HAZARDS: EXTREMELY FLAMMABLE.**

**NOTICE:** Buyer assumes all responsibility for safety and use not in accordance with directions.

**QUESTIONS OR COMMENTS:**  
Call 800-555-5555

**SOLD BY:** ©2001 Generic Pest Brands, Hometown, PA 00998-7765

EPA Reg. No. 99-9999999  
EPS Ext. No. 99999-PA-9

**B**

**C**

**D**

**A**