



# 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 that occur in the 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 (CDC) confirmed sixty-two 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. The West Nile virus has been detected throughout the entire United States. In Pennsylvania, the West Nile virus has been detected every year since 2000.

Lyme disease was 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 deer tick, *I. scapularis*, is most commonly associated with transmitting this disease to humans.

In addition to West Nile encephalitis, mosquitoes can also transmit dog heartworm and the eastern equine, western equine, and St. Louis equine encephalitis viruses. Besides Lyme disease, ticks can transmit Rocky Mountain spotted fever, Colorado tick fever, relapsing fever, tick paralysis, tularemia, babesiosis, and ehrlichiosis. Some of these diseases are present only sporadically, but when they do occur outbreaks can be severe.

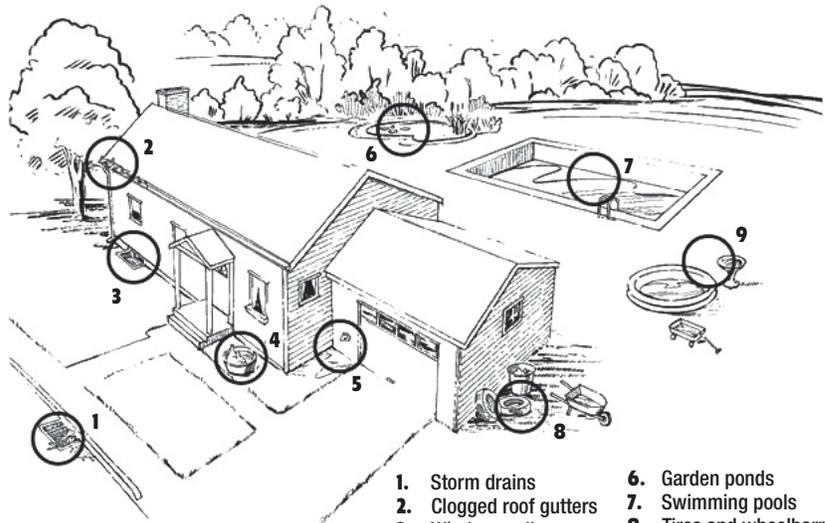
## AVOIDING CONTACT WITH MOSQUITOES AND TICKS

Mosquitoes and ticks prefer certain types of environments. By avoiding these areas or eliminating these en-

vironments 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/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 mosquitoes can breed in any puddle of water during warm weather.

## MOSQUITO BREEDING SITES



- |                                     |                                  |
|-------------------------------------|----------------------------------|
| 1. Storm drains                     | 6. Garden ponds                  |
| 2. Clogged roof gutters             | 7. Swimming pools                |
| 3. Window wells                     | 8. Tires and wheelbarrows        |
| 4. Uncovered containers             | 9. Birdbaths and children's toys |
| 5. Leaky faucets and standing water |                                  |

Ticks thrive in a different type of environment—mainly wooded, brushy, and grassy places—and prefer shaded areas because they are prone to dehydration. 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-m-toluamide or N,N-diethyl-3-methylbenzamide—both 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 Environmental Protection Agency (EPA), DEET is used annually by almost 40 percent of Americans and by about 200 million people worldwide.

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

## CHOOSING AN APPROPRIATE CONCENTRATION OF DEET

A variety of products containing DEET (e.g., lotions, creams, gels, aerosols, pump sprays, and 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 (AAP) has updated their DEET recommendations for children, citing: “Insect repellents containing DEET with a concentration of 10 percent appear to be as safe as products with a concentration of 30 percent when used according to the directions on the product labels.”

Repellent products containing a higher concentration of DEET do not indicate better protection, only that the protection will last longer. 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, such as when the temperature and humidity are high, causing significant perspiration.

However, people differ in how attractive they are to mosquitoes, so the efficacy of a repellent varies among people. Repellents usually remain effective for one to five hours. The length of time depends 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.

## IS DEET SAFE?

Having been in use for more than forty years, DEET has been well studied and has a remarkable safety record. Nevertheless, concerns have been raised about using DEET as a repellent. 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. However, 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

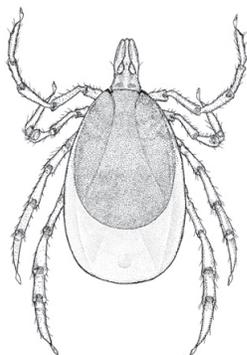
Follow these guidelines when using insect repellents containing DEET, especially when applying them to children.

- 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.
- According to the AAP, DEET should not be used on infants under two months of age. Other guidelines recommend not using DEET until children are two years of age.
- 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 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 because 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.
- If a sunscreen product is needed, it should be applied first, followed by a DEET repellent product. The CDC does not recommend using a combination sunscreen/DEET product.
- 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 National Poison Center at 1-800-222-1222. 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 Information Center at 1-800-858-7378 or visit their Web site at <http://npic.orst.edu/> or contact your health care provider.



## CDC ADOPTS NEW REPELLENT GUIDANCE

In late April 2005, the Centers for Disease Control and Prevention released new guidance about effective mosquito repellents. This guidance included the addition of two active ingredients, picaridin and oil of lemon eucalyptus, which have been shown to offer long-lasting protection against mosquito bites. DEET continues to be a highly effective repellent option and was also included in the CDC updated guidelines.

**Picaridin** (or KBR 3023) has been used safely and effectively in other parts of the world for some time. Evidence shows that picaridin is often comparable with DEET products of similar concentration.

**Oil of lemon eucalyptus** (or p-menthane 3,8-diol or PMD) is a plant-based mosquito repellent that provided protection similar to low concentrations of DEET in two recent studies. The label for this product specifies that it should not be used on children under three years of age.

## ARE THERE OTHER ALTERNATIVES?

If you do not wish to use DEET, other skin application products are available that can provide protection. Keep in mind that commercially formulated natural products (e.g., essential oils) and additives such as fragrances and preservatives have the potential to cause allergic contact dermatitis in sensitive individuals. Furthermore, non-DEET repellents may not be safer for use on children since they have not been as thoroughly studied as DEET.

**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 three 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 allspice, basil, cajeput, cedar, cinnamon, citronella, eucalyptus, garlic, geranium, lavender, lemongrass, pennyroyal, peppermint, pine, rosemary, soybean, thyme, and verbena. Most of these oils give short-lasting protection, generally less than two hours.

**Permethrin** is a synthetic pyrethroid and is the most effective deterrent for ticks. Permethrin is applied to clothing, not to the skin. Permethrin is a powerful, rapidly acting insecticide that kills ticks and insects that come in contact with treated clothes. It can be effective for two weeks or longer if the clothing is not laundered. 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 them to dry for at least two hours (four hours under humid conditions) before wearing.
- Do not treat clothing more than once every two weeks. Launder treated clothing separately from other clothing at least once before retreating.
- Keep treated clothes in a separate bag.

*1. These recommendations were taken from the New York State Department of Health's fact sheet titled "Health Advisory—Tick and Insect Repellents" (2004).*

## 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 nor 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. However, adult ticks can become active any time the temperature goes above 28°F and when there is no snow on the ground.
- Wear light-colored clothing so that ticks can be spotted more easily.
- Tuck pant legs into socks or boots; tuck 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 of the label are described and a fictitious label is illustrated below.

The first thing to 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 for use. The product label will list the active ingredients and their concentration (indicated by the letter "B"). For DEET products, the word "DEET" may not be listed; instead, its chemical name, "N,N-diethyl-m-toluamide," may be listed as the active ingredient. Again, the concentration will help you choose appropriate products for the length of protection that you need.

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. Emergency telephone numbers may also 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 since not all labels are organized in the same way.

Centers for Disease Control and Prevention. *Insect Repellent Use and Safety and Updated Information Regarding Insect Repellents*. [http://www.cdc.gov/ncidod/dvbid/westnile/qa/insect\\_repellent.htm](http://www.cdc.gov/ncidod/dvbid/westnile/qa/insect_repellent.htm)

## REFERENCES

Environmental Protection Agency. *EPA and Mosquito Control*. <http://www.epa.gov/pesticides/factsheets/skeeters.htm>

Fradin, Mark S., and John F. Day. "Comparative Efficacy of Insect Repellents against Mosquito Bites." *The New England Journal of Medicine* 347 (2002): 13–18. <http://content.nejm.org/cgi/content/full/347/1/13/>

Fradin, Mark S. "Mosquitoes and Mosquito Repellents: A Clinician's Guide." *Annals of Internal Medicine* 128 (1998): 931–40. <http://www.annals.org/cgi/content/full/128/11/931/>

National Pesticide Information Center, 1-800-858-7378, <http://npic.orst.edu/>

**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

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EPA Est. No. 99999-PA-9

**B**

**C**

**D**

**A**

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