



## INSECT REPELLENT PRODUCTS

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Biting insects, mites and ticks are a part of our environment. Whether we are hiking in woodlands or gardening in our backyard, we are potentially exposed to these pests. These bloodsucking animals are attracted to people by a number of chemical and physical factors, including carbon dioxide from our breath, body heat and, chemicals in our sweat and on the surface of our skin. Certain colors and textures of clothing and, even the odor from soaps, perfumes, lotions and hair care products may attract mosquitoes and some biting flies. When used sensibly, repellents will provide some personal protection from biting insects and mites. The following information is presented to answer some commonly asked questions about repellents and mechanical devices that allegedly repel insects and ticks.

### Topically applied repellents

A variety of chemicals have been used to repel biting insects and other arthropods such as ticks and mites. The two most commonly used active ingredients are N,N-diethyl-meta-toluamide (DEET) and ethyl hexandiol. DEET repels a greater variety of insects than ethyl hexandiol, and DEET is generally recognized as the most effective active ingredient in repellents.



Mosquitoes, chiggers and ticks are readily repelled by formulations containing DEET. By comparison, deer flies and horse flies are less sensitive to the chemical, but satisfactory relief from these noxious pests may be obtained if the repellent is applied liberally. Repellents may interfere with the insect's ability to detect attractant chemicals that animals produce or they may prevent biting insects from landing. However, they may not keep insects from swarming around prospective victims. Effective repellent products should last several hours of protection if they are not washed off by rain or sweat.

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The Centers for Disease Control and Prevention has recently added two more repellents to its list of recommended repellents:

- Picaridin, also known as KBR 3023, is an ingredient found in many mosquito repellents used in Europe, Australia, Latin America and Asia for some time. Evidence indicates that it works very well, often comparable with DEET products of similar concentration. One product containing 7 percent picaridin is currently distributed in the United States.
- Oil of lemon eucalyptus (also known as p-menthane 3,8-diol or PMD) is a plant-based mosquito repellent that provided protection time similar to **low** concentration DEET products in two recent studies. It is available in a variety of formulations throughout the United States.

Two important points of note about lemon-eucalyptus based products:

- According to the label, oil of lemon eucalyptus products should **NOT** be used on **children under 3 years old**.
- The CDC's recommendation refers only to EPA-registered repellents containing the active ingredient oil of lemon eucalyptus (PMD). "Pure" oil of lemon eucalyptus (e.g. essential oil) has not received similar validated testing for safety and efficacy nor is it registered with EPA as an insect repellent. Therefore, use of only the essential oil is not included in the CDC's recommendation.

Here are some other key points about using DEET and other repellents:

- A variety of repellent formulations can be purchased from drug stores, supermarkets and sporting goods stores. With products containing DEET, the general "rule of thumb" is that products containing 10-30% active ingredient should be effective. You should choose the formulation that best fits your needs; i.e., aerosol formulations for application to clothing, moist towelettes or lotions for application to the face, neck and other body areas.
- Apply repellents only to exposed skin and to clothing that insects can bite through. Never apply repellents to skin that is covered by clothing as this increases absorption of the chemical into the skin which in the case of some repellents may cause an adverse reaction.
- Use the minimum amount needed to cover your skin and/or clothing. Do not overdose yourself or your children. **Avoid repeated application of repellents containing more than 50% DEET to skin over a short period of time.**

#### Current Recommendations for using DEET-based repellents<sup>1</sup>

User's Age	Conc. of DEET	Application Instructions
Six months to less than two years	10% or less	Apply only once daily
Two years to less than 12 years	10% or less	Maximum of three applications daily
12 years and older	30% or less	Follow label precautions

<sup>1</sup> Recommendations are subject to change. **Always read the product label before applying it.**

- When using repellents on children:
  - Never allow children to handle the chemical.
  - Never spray repellents directly on children. Their faces are much closer to their arms and other application sites and aerosol particles can easily get into the eyes, noses or mouths. Apply the product to your hands and then spread it onto their skin for them. A better choice is to use the towelette formulations which you can rub onto their skin. Wash your hands before handling anything else.
  - Do not put repellent on the hands of small children. They might rub their eyes or stick their hands in their mouths and ingest some of the chemical.
  - If you're using a new repellent on children, apply it first to a small area on their arm to make sure that they're not sensitive or allergic to it (from a skin sensitivity perspective).
- Be careful when applying repellents to yourself. Repellents sprayed directly into the eyes will cause irritation and some formulations may damage eye glasses or other synthetic materials. Apply the chemical to your hands then carefully rub it onto your face.
- After returning indoors, bathe or at least wash treated skin with soap and water. This is particularly important when repellents are used repeatedly in a day or on consecutive days. Also, wash treated clothing before wearing it again.
- The CDC discourages the use of products that combine a repellent and sunscreen because the instructions for using each of these components are different and sunscreens are often applied more frequently than a repellent should be.
- If you suspect that you or your child is having an adverse reaction to an insect repellent:
  - Discontinue using it immediately
  - Wash the treated skin with soap and water
  - Call your local poison control center (1-800-222-1222). Have the product/label handy.
  - If you go to a doctor, take the repellent container with you so the doctor can review the label information (or use the label to reference further information). Don't rely on your memory concerning the contents of the product.

### **Other repellent formulations**

- BioUD is a relatively new mosquito repellent that contains undecanone, a chemical that is found in wild tomato plants. Tests of BioUD have shown it to be comparable to DEET in its repellent effects.
- There have also been anecdotal (not scientifically-based) reports that some body lotions repel biting insects. The ingredients in these lotions do not possess any repellent properties. Instead, the mineral oil in these products creates a barrier film that prevents the insect's mouthparts from

penetrating the skin. These lotions are more likely effective against sand flies ("no-see-ums") and other biting insects with short mouthparts as compared to that of the mosquito.

- Another repellent, Permethrin (permethrin), is applied to clothing only (NOT to your skin). It exerts a toxic action quickly repelling most mosquitoes and biting flies, as well as fleas, ticks and chiggers.
- Oil of Citronella, which is extracted from *Andropogon nardus* or "citronella grass", has been used as a mosquito repellent since 1882. "Citronella candles" are commonly burned outdoors to repel mosquitoes and other biting insects from around porches, decks and picnic areas. These candles will be most effective where there is relatively little air movement that would disperse the volatile chemicals too quickly away from the area you are trying to protect.
- There are products similar to the citronella candles but they contain regular insecticides such as allethrin. These products should be used outdoors only in areas that are not subject to breezes.

### **Systemic repellents**

Vitamin B1 (thiamine chloride), garlic, brewer's yeast and other plant-based chemicals have been reported to repel mosquitoes when taken orally. Some of these materials are marketed in tablet form, and the manufacturers claim that protection from mosquitoes will last up to 24 hours after taking one tablet. To date, the results of several scientific studies do not support the claims that these materials are effective repellents for mosquitoes or other biting insects, mites or ticks.

### **Repellent Plants**

In recent years, plants such as *Citrosa* have been promoted as having mosquito repellent properties. These plants contain many of the same chemicals found in oil of citronella. However, results of scientific studies of these plants have not supported the claims of effective mosquito-repellency in outdoor areas.

### **Fabric Softeners**

There have been reports, mostly on the Internet, that the sheets of certain fabric softeners normally used to soften laundry also repel mosquitoes if applied to your skin. To date, there have been no scientific studies that show this claim to be valid.

### **Electronic pest repellers**

A variety of battery powered ultrasonic pest repelling devices (e.g., flea/tick collars, hanging or pocket devices for mosquitoes) can be purchased from retail outlets or mail order companies. Manufacturers allege that the high frequency sound emitted by these devices "repel" mosquitoes, ticks, fleas and even cockroaches. Scientific tests of these devices do not indicate that they repel or reduce the attack of biting insects, ticks or mites, nor do they eliminate cockroach infestations.

For additional information, see our publications at <http://insects.ncsu.edu/Urban/biting.htm>

Pest information and control recommendations presented here were developed for North Carolina and may not be appropriate for other states or regions. Any recommendations for the use of chemicals are included solely as a convenience to the reader and do not imply that insecticides are necessarily the sole or most appropriate method of control. Any mention of brand names or listing of commercial products or services in the publication does not imply endorsements by North Carolina Cooperative Extension nor discrimination against similar products or services. All recommendations for pesticide use were legal at the time of publication, but the status of pesticide registrations and use patterns are subject to change by actions of state and federal regulatory agencies. Individuals who use chemicals are responsible for using these products according to the regulations in their state and to the guidelines on the product label. Before applying any chemical, always obtain current information about its use and read the product label carefully. For assistance, contact the Cooperative Extension Center in your county