

Use and Application of Insect Repellents¹

P. G. Koehler, R. M. Pereira, and R. A. Allen²

Other Insect Repellents

For a long time DEET was the only active ingredient used in insect repellents. Recent research and development has led to several other products which are now available in the marketplace as replacements for DEET products.

DEET or diethyltoluamide is an effective repellent of mosquitoes, gnats, ticks, mites, and blood-sucking flies. It has been used effectively for the past 45 years to prevent insect bites and disease transmission. Recently, DEET has been extensively used to protect humans from bites of arthropods that transmit Lyme disease and encephalitis. Along with the increased use of DEET, there is concern about the adverse effects of DEET on humans. For instance, six cases of DEET poisoning in small children have been reported after the repeated use or ingestion of DEET.

New insect repellents have been introduced in the marketplace, resultants from research into other compounds that could offer similar protection but without some of the collateral effects associated with DEET. These new products offer efficient alternatives and may replace DEET products in most applications. Discussion on these new products can be found at the end of this publication/chapter.

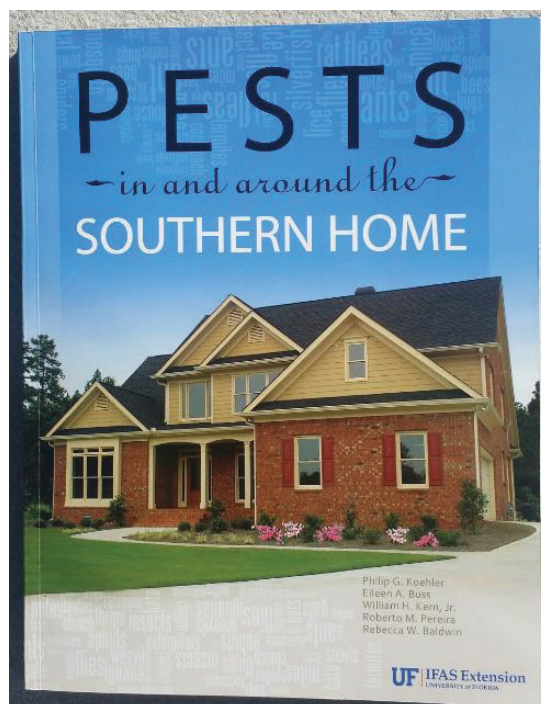


Figure 1. This fact sheet is excerpted from SP486: Pests in and around the Southern Home, which is available from the UF/IFAS Extension Bookstore. <http://ifasbooks.ifas.ufl.edu/p-1222-pests-in-and-around-the-southern-home.aspx>.

Credits: UF/IFAS

Selection of Products Containing DEET

DEET is formulated in products containing 5 to 100% DEET. Usually products containing 15 to 40% DEET work

1. This document is ENY-260, one of a series of the Entomology and Nematology Department, UF/IFAS Extension. Original publication date March 1994. Revised May 1997, February 2008, October 2013, and February 2022. Visit the EDIS website at <https://edis.ifas.ufl.edu> for the currently supported version of this publication.
2. P. G. Koehler, professor emeritus; R. M. Pereira, Extension professor; and R. A. Allen, former graduate student; Entomology and Nematology Department, UF/IFAS Extension, Gainesville, FL 32611.

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution authorized to provide research, educational information and other services only to individuals and institutions that function with non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. For more information on obtaining other UF/IFAS Extension publications, contact your county's UF/IFAS Extension office. U.S. Department of Agriculture, UF/IFAS Extension Service, University of Florida, IFAS, Florida A & M University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Andra Johnson, dean for UF/IFAS Extension.

best for adults. Products containing no more than 8 to 10% DEET are recommended for children. In general, the higher percentages provide longer and better protection than those with lower percentages.

DEET usually provides one to three hours of protection in typical situations. When an individual is swimming or sweating extensively, protection will last a shorter time. Therefore, DEET must be reapplied, as needed, to provide continuing protection.

Application of DEET Products

DEET products are available as liquids, lotions, and aerosols. They should be applied as directed on the label. Before using any DEET product, read the entire label. Even if you have used the product before, read it again before application as product labels and use instructions change overtime.

Liquids and lotions should be poured or squeezed directly onto the hands and spread evenly and completely on exposed skin in a thin layer. Contact with the eyes and lips should be avoided. Use just enough repellent to cover the exposed skin. Wipe or wash hands after completion of application.

Aerosols should be directed at the area to be treated from the appropriate distance, usually about 6 to 8 inches from the exposed skin. Aerosols should not be applied directly to the face, but rather sprayed onto hands and then rubbed onto the face and neck, avoiding contact with eyes and lips.

Reapply DEET formulations as necessary, but avoid overexposure. Frequent reapplication and saturation are unnecessary. Also, do not apply DEET to the hands of small children.

Apply DEET formulations, to exposed skin; do not apply to areas underneath clothing. DEET will damage plastic materials, so do not apply DEET formulations on or near plastics, acetate, rayon, Spandex, synthetic fabrics (other than nylon), furniture finishes, leather, watch crystals, and painted or varnished surfaces. Plastic glass frames and goggles should be protected from DEET applications. Car finishes and interiors also may be damaged by DEET. It will not damage nylon, cotton, or wool fabrics.

Precautionary Statements for DEET

DEET may cause eye injury or irritate mucous membranes. Therefore, do not apply to eyes or lips. It may also be

harmful if swallowed. In rare cases, it can cause skin reaction. Do not apply to sunburned or damaged skin.

If DEET gets in eyes, flush with plenty of water. If eye irritation persists, get medical treatment. If swallowed, call a physician or contact a poison control center. If a child or adult reacts to the dermal application of DEET, wash treated skin and call a doctor.

Many older DEET products contained an R-11 additive to enhance activity. Because of concerns about the additive, all current products do not contain it. Do not use DEET products that were manufactured prior to 1993 to avoid exposure to the additive.

Minimizing DEET Exposure

Because of the concern about the health effects of using DEET, DEET use and exposure should be minimized. The most obvious way to minimize use and exposure is to avoid bloodsucking arthropods. This may be accomplished by staying on walkways to avoid ticks and remaining indoors during early morning and evening hours when mosquitoes and gnats are most prevalent. Screening of doors and windows or use of mosquito netting will also avoid the use of DEET.

When exposure to bloodsucking arthropods is unavoidable, DEET use can be minimized by covering most of the body with clothing. Long sleeved shirts, buttoned collars, and long trousers will cover most of the body and protect skin from insect attack. Therefore, only the face, neck, hands, and wrists must be treated with DEET repellent. Removal of DEET from hands after application will also minimize exposure from wiping eyes or contacting food.

After returning indoors, wash treated skin with soap and water or bathe. This is especially important when repellents are used repeatedly or on consecutive days. Also, keep DEET in its original container so it is not accidentally ingested.

DEET and Children

Three-fourths of all DEET poisonings occur with children under six years of age. Small children are more vulnerable because they are more likely to accidentally ingest DEET and they have lower body weights. Store containers of DEET out of the reach of children to prevent accidental poisoning.

Also, use common sense in the application of DEET to small children. Do not apply to the hands of children

because they may rub their eyes or ingest DEET from their hands or fingers. Do not allow small children to apply the product. An adult should apply the product or closely supervise the application. Use DEET sparingly on small children. The US Food and Drug Administration (FDA) recommends that DEET products should not be used on children under two months of age.

Other insect repellents are now available and should be considered for use by those who cannot tolerate DEET products. Picaridin and oil of lemon eucalyptus are both registered with the EPA and have demonstrated effective insect repellency. Picaridin has proven to be similarly effective to DEET against certain mosquito species.

The following table, taken from the “Insect Repellents - Topic Fact Sheet” found in the web page from the National Pesticide Information Center, offers a comparison of the toxicity of the different ingredients use in commercial insect repellents:

People have reported skin and eye irritation from products with picaridin. Vomiting has also been reported. IR3535 is an eye irritant and can cause skin irritation if used in high doses. Oil of lemon eucalyptus can also cause significant eye damage, but washing eyes after an exposure can reduce the risks. Oil of lemon eucalyptus has also been linked to skin irritation, effects on locomotion, changes in breathing and slow reaction in animals.

Read the labels carefully and follow all instructions. For instance, products containing oil of eucalyptus are not recommended for use on children under 3 years of age, according to the United States FDA.

Table 1. Short-Term Toxicity of Active Ingredients in Common Insect Repellents*

Repellent	Oral	Inhalation	Dermal	Eye Irritation	Skin Irritation
DEET	Low	Very Low	Low	Low	Very Low
Picaridin	Low	Very Low	Low	Low	Very Low
IR3535	Very Low	Very Low	Very Low	Moderate	Very Low
Oil of Lemon Eucalyptus	Very Low	Very Low	Very Low	High**	Very Low

* None of these ingredients are expected to cause more severe reactions with multiple exposures over time (sensitizers).
** If oil of lemon eucalyptus gets into the eye, washing the eye immediately can reduce irritation and risk of long-term damage. Follow First Aid instructions on the [product label](#).