ENY-671

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Mosquito Repellents[1]

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Female mosquitoes feed on blood to help their eggs develop into offspring (Figure 1). When she bites, she releases her saliva into the area where she is biting. Her saliva contains proteins that may cause some people to have an allergic reaction such as itchy red bumps and swollen hives. For those with increased sensitivity to bites, a blister, bruise, or large inflammatory reaction can occur. If a mosquito is harboring a virus, it is possible that she can transmit the virus to humans through her saliva. In Florida, the viruses that mosquitoes transmit can cause encephalitis. The most important mosquito-borne diseases in Florida are St. Louis encephalitis, eastern equine encephalitis, and West Nile virus encephalitis.

The best ways to avoid mosquito bites are to avoid infested areas, wear protective clothing, and wear insect repellent.

How Do Mosquito Repellents Work?

Repellents make humans unattractive to a mosquito so that it will avoid areas of the body that have been treated with the product. Repellents do not kill mosquitoes. The best repellents will provide protection from bites for a long period of time from just one application. The University of Florida

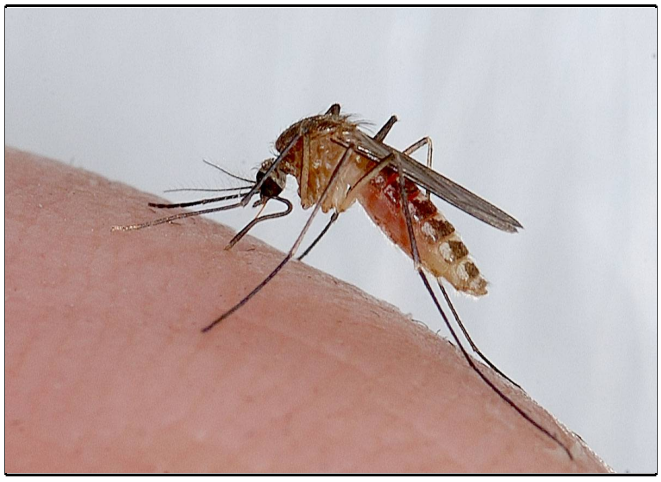

Figure 1. Female mosquito taking a blood meal Credits: James Newman UF/IFAS/FMEL

mosquito researchers test and evaluate the effectiveness of mosquito repellents based on the amount of time the product will continue to repel mosquitoes after one application to the skin. This is known as Complete Protection Time (CPT).

What Kind Of Mosquito Repellents Are Available?

Repellents that are currently available are either synthetic chemicals, such as DEET, or plant derived chemicals such as Citronella. Various formulations of

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these repellents are available that differ in the amount of active ingredient, which is the substance that actually repels the mosquito. These products are available as sprays, wipe-on's, sticks, foams, and lotions.

Product Labels

It is very important to read the label before using any mosquito repellent and remember the following:

- Both N,N-diethyl-m-toluamide and N,N-diemethylbenzamide are chemical names for DEET; the label may or may not have the word "DEET" on it
- There are different recommendations for frequency of application for different repellents; do not over apply
- Check the container for an EPA-approved label and registration number; never use a repellent that has not been approved for use by the EPA
- Make sure that the repellent label lists the insect that you need to repel; some repellents are not formulated for certain insects

What About Products That Combine Repellents And Sunscreen?

The Centers for Disease Control (CDC) does not recommend using products that combine DEET with sunscreen. Sunscreens are intended for generous and frequent use while DEET is intended for less frequent use. The concern is that use of a repellent that combines the two compounds may promote increased and unnecessary use of DEET. Additionally, blending DEET with a sunscreen decreases the efficacy of both compounds. The CDC recommendation is to apply suncreen first, then the insect repellent containing DEET, to be sure that each product works as specified.

What About Devices That Emit Sound To Repel Mosquitoes?

There is no evidence that wearing devices that emit sound will repel mosquitoes.

Will Garlic, Bananas, Or Vitamin-B Repel Mosquitoes?

There is no scientific evidence that eating garlic, vitamins, onions, or any other food will make a person repellent to mosquitoes. The attractant level of each individual to biting arthropods is based on a complex interaction of many chemical and visual signals. Certain foods in certain individuals may effect their individual attractiveness to biting arthropods, for better or for worse.

How To Decide Which Repellent Is Best

Read the label to determine what the active ingredient is and what percentage of the active ingredient is in the container. Use Table 1, based on University of Florida research, as a guideline to compare products. Some provide protection for a long period of time and some have very short protection times.

In 2005, the CDC revised their recommendations on mosquito repellents and added two repellents, in addition to DEET: Picaridin [1-Piperidinecarboxylic acid, 2-(2-hydroxyethyl)-, 1-methylpropylester] and Oil of Lemon-Eucalyptus [p-menthane 3,8-diol (PMD)]. The oil of lemon eucalyptus has not been tested against mosquitoes that spread malaria and some other diseases which occur internationally. The label for oil of lemon eucalyptus specifies that it should not be used on children under 3 years of age.

Keep in mind that repellents do not protect all users equally. The effectiveness of a repellent depends on the mosquito species that is biting as well as the age, sex, level of activity, and attractivness of the human using the repellent. Consider the following when choosing a repellent:

- Are you in an area where you know that mosquito-borne diseases are present?
- What is the mosquito population like? (A lot of bites expected? Or occasional bites?)
- Will time spent outdoors at night be longer than an hour?

- Will you be around heavily vegetated, humid areas during the day?
- What type of activities are going on: exercising, running, playing sports, etc.?
- Is the humidity and temperature high?
- Do not apply to the mouth or eyes, cuts, wounds, or on sunburned or irritated skin.
- To apply to face, spray on hands first and then rub on face.

Table 1. Protection Times of Tested Mosquito Repellents

Products	Active Ingredient	Average Complete Protection Time
OFF! Deep Woods	23.8% DEET	5 hours
Sawyer Controlled Release	20% DEET	4 hours
OFF! Skintastic	6.65% DEET	2 hours
Repel Lemon Eucalyptus Insect Repellent	Oil of lemon eucalyptus; p-menthane 3,8-diol (PMD)	2 hours
Bite Blocker for Kids	2% Soybean Oil	1.5 hours
OFF! Skintastic for Kids	4.75% DEET	1.5 hours
Skin-So-Soft Bug Guard Plus	7.5% IR3535	23 minutes
Natrapel	10% Citronella	20 minutes
Herbal Armor	12% Citronella; 2.5% peppermint oil; 2% cedar oil; 1% lemongrass oil; 0.05% geranium oil	19 minutes
Green Ban for People	10% Citronella; 2% peppermint oil	14 minutes
Buzz Away	5% Citronella	14 minutes
Skin-So-Soft Bug Guard	0.1% Citronella	10 minutes
Skin-So-Soft Bath Oil	Active Ingredient not known	10 minutes
Skin-So-Soft Moisturizing Suncare	0.05% Citronella	3 minutes
Gone Original Wristband	9.5% DEET	0
Repello Wristband	9.5% DEET	0
Gone Plus Repelling Wristband	25% Citronella	0

How To Apply Mosquito Repellents

- READ THE LABEL!!! Apply according to the directions on the label. Do not use any repellent that has not been approved by the EPA. To find this information, you can visit the EPA's Web site www.epa.gov or look for an EPA registration number on the label.
- As with all over-the-counter products, use common sense when applying. Watch for reactions, some people may be allergic to ingredients in the repellent.
- Apply ONLY to the parts of the body that are exposed. Some repellents can be applied directly to clothing, but check the label first. Do not apply to skin that will be covered by clothing.
- Do not allow young children to apply repellents.
- Apply only as often as the label says. More is NOT better! If the repellent wears off earlier than expected, read the label to determine how often it is safe to re-apply.
- Keep in mind that some things may decrease the effectiveness of a repellent such as: activities

that cause perspiration, high humidity, high temperature, rainfall, and swimming

Safety of Mosquito Repellents

The EPA has determined that the normal use of DEET does not present a health concern to the general U.S. population and is not classifiable as a human carcinogen. The American Academy of Pediatrics updated their recommendation for the use of DEET products on children (2005) to state that repellents containing DEET with a concentration of 10% appear to be as safe as products containing a 30% concentration when used according to the directions on the label. They suggest that it is acceptable to apply repellents with low concentrations of DEET to infants over 2 months old. Non-DEET repellents have not been as thoroughly studied as DEET, and may not be safe to use on children. There are no reported adverse events following use of repellents containing DEET in pregnant or breastfeeding women.

Oil of lemon eucalyptus should not be used on children under 3 years of age. In the University of Florida research, summarized in Table 1, it should be noted that one subject experienced a skin reaction when testing the efficacy of the oil of lemon eucalyptus; the subject discontinued that portion of the study.

"Natural" Products

"Natural" is a word that is sometimes used to promote "safe" products. Unfortunately, the wording can be misleading for the uninformed individual. "Natural" products are usually essential oils distilled from plants; oils that have evolved with plants to defend the plant from insect feeding. These oils can be toxic and irritating in high concentrations. "Natural" repellents are not necessarily *safe* repellents.

In some cases, use of any repellent product may cause skin reactions. Anyone who suspects they are having a reaction to the repellent should discontinue use, wash the treated area and call the National Poison Control Center to find the closest center: 1-800-222-1222.

Useful References

-How to use insect repellents safely

http://www.epa.gov/pesticides/citizens/insectrp.htm

-Reregistration of the insect repellent DEET

http://www.epa.gov/opp00001/citizens/deet.htm

-Updated information regarding mosquito repellents.
http://www.cdc.gov.ncidod/dvbid/westnile/qa/insect_repellent.htm

Fradin, M. S. and J. F. Day. 2002. Comparative efficacy of insect repellents against mosquito bites. N. Engl. J. Med. Vol. 347(1)13-18.