

## **Insect Repellent Buying Guide**

Our ratings identify which products work best against mosquitoes and ticks. (We did not test all our products against ticks, but our research indicates that any product that protects you from mosquito bites will also protect you from tick bites.)

Choosing the right repellent matters: Our top products provided several hours of protection, and some of our lowest-scoring ones failed almost immediately.

### **How We Test**

We tried out a variety of repellents to see if they were up to the task. Our brave testers stuck their arms into cages full of disease-free female mosquitoes in need of a blood meal to lay their eggs, and then watched and recorded bites for 5 minutes every hour. A repellent failed if a tester was bitten two or more times in one 5-minute session or once in two consecutive sessions.

In the products we tested against ticks, we marked each tester's bare arms with three lines, then released, one at a time, five disease-free deer ticks to crawl on them. The repellent failed if two ticks crossed into the treated area.

### **Ingredient Info**

In our most recent survey of insect-repellent users, about half said they don't read the labels before buying them. That's a mistake, because the active ingredient and concentration matters to both effectiveness and safety.

Products with any one of these three active ingredients—deet, oil of lemon eucalyptus, and picaridin—generally worked well in our tests.

And all are safe, even for pregnant women, when used appropriately. Here's what you need to know about each:

## **Deet**

Many people assume that the more deet (N, N-diethyl-meta-toluamide) a product contains, the better. But our tests found that products with 15 to 30 percent deet can provide long-lasting protection against mosquitoes and ticks. And some research suggests that higher concentrations and excessive doses can pose risks, including rashes and possibly even disorientation and seizures.

That's why we say you should avoid repellents with more than 30 percent deet and not use those products at all on babies younger than 2 months. (See below for how to safely apply all repellents.) But make sure you don't go too low: The product in our insect repellent ratings with just 7 percent deet didn't work well.

## **Picaridin**

This is a synthetic repellent modeled after a compound that occurs naturally in the black pepper plant. We recommend two 20 percent picaridin products, both sprays.

But concentration matters: Another picaridin product, this one just 5 percent, was one of our lowest-scoring insect repellents. And, at least when it comes to picaridin, form seems to matter, too. We found that the 20 percent lotion we tested did not work as well as the 20 percent picaridin spray. Finally, while picaridin seems safe, even for use on infants, it can irritate your skin and eyes, so you should use it carefully (see below).

## **Oil of Lemon Eucalyptus**

This is a naturally occurring compound, extracted from the gum eucalyptus tree; a product in our insect repellent ratings that contained 30 percent oil of lemon eucalyptus (OLE) did well in our tests, warding off mosquitoes and ticks for at least 7 hours.

All the other products with plant oils—including cedar, cinnamon, citronella, clove, geranium, lemongrass, rosemary, and peppermint—provided little protection, often failing in our tests within a half-hour. OLE also appears to be relatively safe when used properly, though it can cause temporary eye injury, and the Food and Drug Administration recommends against using it on children younger than 3.

## **IR3535 and 2-Undecanone**

In our tests, products with these two ingredients were less effective (compared with DEET, picaridin, and OLE), offering limited protection. IR3535 is a man-made compound that is structurally similar to a naturally occurring amino acid.

And 2-Undecanone is a synthesized version of a compound found in rue, wild tomatoes, and several other plants.

Both products appear relatively safe but, as with all repellents, should be used with caution, especially on children.

## **The Buzz: Things to Think About**

### **Be Wary of ‘Natural’ Repellents**

Several makers of “natural” insect repellents (which typically contain essential plant oils like cedar, citronella, lemongrass, and rosemary) claim that their products can help ward off mosquitoes, including those

that carry the Zika virus. But our tests show that was true only for the product we tested with oil of lemon eucalyptus.

### **Don't Buy Based on Just Ingredient or Concentration**

Some of our top-rated product contains picaridin, but so do some of our lower-rated ones. Concentration and form probably explain some of that difference: High-scoring products are sprays that contain 20 percent picaridin, and the low-scoring ones contain less picaridin or come in a lotion form.

### **Don't Use Combination Sunscreen-Insect Repellent Products**

We're not fans of these combo products—sunscreen should be reapplied every 2 hours, which could over-expose the user to the chemicals in repellents.

### **The Right Way to Apply Repellents**

Proper application and use is essential, both for maximum protection and to avoid possible side effects, including skin or eye irritation. That means:

- Apply repellent only to exposed skin or clothing (as directed on the product label). Never put it on under clothing.
- Use just enough to cover and only for as long as needed; heavier doses don't work better and can increase risks.
- Don't apply repellents over cuts, wounds, or irritated skin. When applying to your face, spray first on your hands, then rub in, avoiding your eyes and mouth, and using sparingly around ears.
- Don't let young children apply. Instead, put it on your own hands, then rub it on. Limit use on children's hands because they often put their hands in their eyes and mouths.
- Don't use near food, and wash hands after application and before eating or drinking.
- At the end of the day, wash treated skin with soap and water, and wash treated clothing in a separate wash before wearing again.
- Some directions suggest using repellents on clothes, but most of the

ones we tested damaged leather and vinyl, and some of them stained synthetic fabrics. Wash repellent off your skin and launder treated clothes.