

## QUICK LINKS

## Insect Precautions—TRAVELER INFORMATION

• Personal Protection Measures • Insecticides

## Traveler Information

## INSECT PRECAUTIONS

In the tropics, insects can transmit significant illnesses such as malaria, dengue, yellow fever, and rickettsial disease—some potentially life-threatening. These diseases are best prevented by personal protective measures. In some cases (e.g., malaria or yellow fever), a preventive drug or vaccine is available as well but should never replace personal protection measures. Travelers to areas where insects that transmit these diseases may be present can help minimize their risk by following the insect precautions and protective measures discussed below.

## PERSONAL PROTECTION MEASURES

- Wear clothing that exposes as little skin as is practicable.
- Apply a repellent containing the insecticide DEET (concentration 30-35%) or picaridin (concentration 20% or greater for tropical travelers).
  - Picaridin products in the U.S. with 20% concentration include Natrapel (Tendercorp) and Picaridin Insect Repellent (Sawyer). Picaridin is also known as Icaridin in some countries.
  - Picaridin has a pleasant smell, an advantage over DEET.
- The repellent should be applied to all exposed nonsensitive areas of the body. Frequent application ensures continuous protection.
- The time of day and type of insects to be avoided determine when the repellent should be applied.
  - Mosquitoes that transmit malaria (*Anopheles* mosquitoes) are generally night biters. In risk areas, be especially vigilant in applying repellent from dusk to dawn.
  - Mosquitoes that transmit dengue, chikungunya, and yellow fever (*Aedes* mosquitoes) are generally day biters. In risk areas, be especially vigilant in applying repellent during daytime hours, especially during peak biting times during the early morning hours and again in late afternoon.
  - Mosquitoes that transmit West Nile virus and Japanese encephalitis (*Culex* mosquitoes) are most active at dusk and again at dawn. In risk areas, be especially vigilant in applying repellent from dusk to dawn.
- Consider treating outer clothing, tents, and sleeping bag liners with permethrin (or other pyrethroid) when traveling in an area of very high risk for malaria or other mosquito-borne or tick-borne diseases.
- If not sleeping in a sealed, air-conditioned room, sleep under a permethrin-impregnated bed net when at high risk of malaria. Regularly check the net for rips and tears, and keep it tucked in around the bed at all times. Ensure that all open windows have insect screens.
- Use an aerosol insecticide before going to bed and a vaporizer device throughout the night.
- Outdoors, a smoldering pyrethroid coil can be used to reduce flying insects.
- In areas where tick-borne disease is a risk, perform a full body check at least once a day.

## INSECTICIDES

The most effective repellents contain **DEET** (N, N diethylmeta-toluamide) or **picaridin** (Natrapel, Picaridin Insect Repellent, Cutter Advanced, Cutter Advanced Sport, KBR3023, Bayrepel, Autan, (RS)-sec-butyl 2-(2-hydroxyethyl). Picaridin is now considered to have comparable efficacy and duration of protection to DEET *at the same concentration*. Both compounds have now been shown to be effective under actual field conditions in tropical countries against both *Anopheles* and *Aedes aegypti* mosquitoes.

**Duration of protection:** With both DEET and picaridin, the duration of effectiveness increases as the concentration of repellent increases. With DEET, the effect on duration of protection plateaus at about 50% concentration. Products with less than about 20% picaridin or DEET have a relatively short duration of protection and should be discouraged for use in tropical travelers. The optimal concentration of DEET is considered to be 30-35%. When used by tropical travelers in *appropriate concentrations* (that is, 20% or greater), picaridin should be applied every 4-6 hours. In the U.S., there are 2 products containing 20% picaridin: Natrapel (Tendercorp) and Picaridin Insect Repellent (Sawyer).

**Use in children:** Both DEET and picaridin-containing repellents can be used in children  $\geq$  2 months of age. The maximum concentration of DEET that should be used in children is 30%. There is no information on the maximum concentration of picaridin for children. Picaridin is more pleasant smelling than DEET.

**Use in pregnancy and breastfeeding:** DEET and picaridin can be used by pregnant and breastfeeding women but should not be applied directly to the abdomen or nipple area. While DEET has been shown in 1 short-term study to be safe in the second and third trimesters of pregnancy when used at concentrations up to 20%, the use of DEET in the first trimester has not been well studied. Because of the seriousness of malaria in pregnancy, if extensive exposure is anticipated, pregnant women should consider using concentrations of 20-35%. Controlled-release formulations appear to last longer and require less frequent application. Although there is no evidence that the use of DEET or picaridin by pregnant or lactating women poses a health hazard to unborn babies or children who are breastfeeding, there are no long-term follow-up studies available.

**Safety:** DEET is effective against mosquitoes, ticks, fleas, and chiggers and is a remarkably safe insect repellent; only 30 cases of severe toxicity have been reported among billions of uses over 30 years. Most cases of toxic encephalopathy or seizures were reported in young children in whom excessive amounts were used over prolonged periods. There is no long-term information available on the use of picaridin but toxicity tests in animals have shown it to be extremely safe.

The use of another repellent, **IR3535** (3-(N-acetyl-N-butyl) aminopropionic acid ethyl ester; Bug Guard Plus), is more controversial, and conflicting data exist over its effectiveness. IR3535 is recommended by WHO as equivalent to picaridin at the same concentration. IR3535 repellents can be used in children  $\geq$  6 months of age, but due to a lack of data, they should not be used by pregnant or nursing women. In the U.S., IR3535 repellents are available in a range of concentrations up to 20%.

An increasing number of botanical repellents containing eucalyptus, citronella, soybean oil, geranium oil, castor oil, and 2-undecanone are marketed. At present insufficient evidence exists that these are viable alternatives to DEET or picaridin.

The following precautionary measures can minimize the possibility of adverse reactions to insect repellent containing DEET or picaridin:

- Use repellents according to label directions.
- Apply repellents sparingly and only to exposed skin or clothing.
- Repellents should not be inhaled or ingested and contact with the eyes should be avoided.
- Avoid applying repellents to portions of children's hands that are likely to have contact with eyes or mouth.
- Never use repellents on wounds or irritated skin.
- Wash repellent-treated skin after coming indoors if there is no further risk of exposure to insects.
- If a suspected reaction to insect repellent occurs, wash treated skin and seek medical attention.
- Pregnant and nursing women should minimize use of repellents since about 6-9% of the chemical is absorbed through the skin.

Travelers also should purchase a pyrethroid-containing flying-insect spray to use in living and sleeping areas during evening and nighttime hours.

For added protection against mosquitoes, bednets and clothing may be soaked in or sprayed with permethrin. Permethrin is an insecticide licensed for use on clothing; when applied according to directions it can be effective on clothing for several months and on bednets for half a year. Permethrin physically binds to the fabric, which then can be repeatedly washed without loss of effect; this also prevents absorption through skin. In some countries, deltamethrin liquid is available.

Use of brand names is for informational purposes only and does not constitute preference for one brand over another.

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