

**Skin-So-Soft Bath Oil**, which consumers commonly claim has a repellent effect on insects, provided only a mean of **9.6 minutes of protection** against aedes bites in our study. This extremely limited repellent effect has previously been documented in other studies.

Thousands of plants have been tested as potential botanical sources of insect repellent. Most plant-based insect repellents currently on the market contain essential oils from one or more of the following plants: citronella, cedar, eucalyptus, peppermint, lemongrass and geranium. **All botanical repellents** that we tested in our initial studies, regardless of their active ingredients and formulations, gave **very short-lived protection**, ranging from a mean of about **3 to 20 minutes**.

Certain plant-derived repellents may provide short-lived efficacy. Frequent reapplication of these repellents would partially compensate for their short duration of action. However, when one is travelling to an area with prevalent mosquito-borne disease that could be transmitted through a single bite, the use of non-DEET repellents would seem ill advised.

**Given our findings, we cannot recommend the use of any currently available non-DEET repellent to provide complete protection from arthropod bites for any sustained outdoor activity.**

Although this study shows that DEET-based products can be depended on for long-lasting protection, they are not perfect repellents. DEET may be washed off by perspiration or rain, and its efficacy decreases with rising outdoor temperatures.

TABLE 1 . PROTECTION TIMES OF INSECT REPELLENTS

Product	Active Ingredient & Concentration	Complete Protection Time		Category of Protection
		Mean	Range	
OFF! Deep Woods	DEET, 23.8%	301.5 + 37.6	200 - 360	A
OFF! Skintastic	DEET, 6.65%	112.4 + 20.3	90 - 170	C
OFF! Skintastic for Kids	DEET, 4.75%	88.4 + 21.4	45 - 120	D
Skin-So-Soft Bug Guard Plus (Avon)	IR3535, 7.5%	22.9 + 11.2	10 - 60	E
Buzz Away	Citronella, 5%	13.5 + 7.5	5 - 30	E
Skin-So-Soft Bug Guard (Avon)	Citronella, 0.1%	10.3 + 7.9	1 - 30	E
Skin-So-Soft Bath Oil (Avon)	Uncertain	9.6 + 8.8	1 - 30	E
Skin-So-Soft Moisturising Suncare (Avon)	Citronella, 0.05%	2.8 + 3.4	1 - 15	F
Gone Original Wristband	DEET, 9.5%	0.3 + 0.2	0.17 - 1.33	G
Repello Wristband	DEET, 9.5%	0.2 + 0.08	0.17 - 0.63	H
Gone Plus Repelling Wristband	Citronella, 25%	0.2 + 0.09	0.17 - 0.48	H

Most alternatives to topically applied repellents have proved to be ineffective. No ingested compound, including **garlic & thiamine (vitamin B1)**, has been found to be capable of repelling biting arthropods. Small, wearable devices that emit sounds that are purported to be abhorrent to biting mosquitoes have also been proved to be ineffective. In our study, **wristbands** impregnated with either DEET or citronella similarly **provided no protection** from bites, consistent with the **known inability of repellents to protect beyond 4 cm from the site of application**.

Multiple factors play a part in determining how effective any repellent will be: these factors include the species of the biting organisms and the density of organisms in the immediate surroundings: the user's age, sex, level of activity, and biochemical attractiveness to biting arthropods; and the ambient temperature, humidity and wind speed. As a result, a given repellent will not protect all users equally. Examination of the ranges of complete-protection times in Table 1 shows variation in the ability of each repellent to protect different subjects.

**Our study shows that only products containing DEET offer long-lasting protection after a single application.**

Despite the substantial attention paid by the lay press every year to the safety of DEET, this repellent has been subjected to more scientific and toxicologic scrutiny than any other repellent substance. The extensive accumulated toxicologic data on DEET have been reviewed elsewhere. DEET has a remarkable safety profile after **40 years of use** and nearly **8 billion human applications**. Fewer than 50 cases of serious health effects have been documented in the medical literature since **1960**, and three quarters of them resolved without sequelae. Many of these cases involved long-term, heavy, frequent or whole-body application of DEET. **No correlation has been found between the concentration of DEET used and the risk of toxic effects**. As part of the Re-registration Eligibility Decision on DEET, released in 1998, the U.S. Environmental Protection Agency reviewed the accumulated data on the toxicity of DEET and concluded that **"normal use of DEET does not present a health concern to the general population"**. When applied with common sense, DEET-based repellents can be expected to provide a **safe as well as a long-lasting repellent effect**. Until a better repellent becomes available, DEET-based repellents remain the **gold standard of protection** under circumstances in which it is crucial to be protected against arthropod bites that might transmit disease.