This citrus-scented tree oil kept mosquitoes at bay for nearly four hours

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Flowers of May Chang (Litsea cubeba), the source of the essential oil used in the 6% mosquito repellent spray tested in the study. Credit: https://plantsnap.com/plant-encyclopedia/Magnoliopsida/Lauraceae/litsea-cubeba

Mosquitoes have posed a threat to human beings since time immemorial. They not only disturb sleep by their incessant buzzing but have also been carriers of deadly diseases. In combating the transmission of diseases via mosquitoes, insect repellents play an important role. However, chemical

mosquito repellents that have active substances such as DEET and allethrin may cause rashes, irritation in the eyes, and may even cause breathing problems such as asthma.

It has been a challenge for scientists to find new alternatives, especially gentler plant-based ones that could replace chemical formulations.

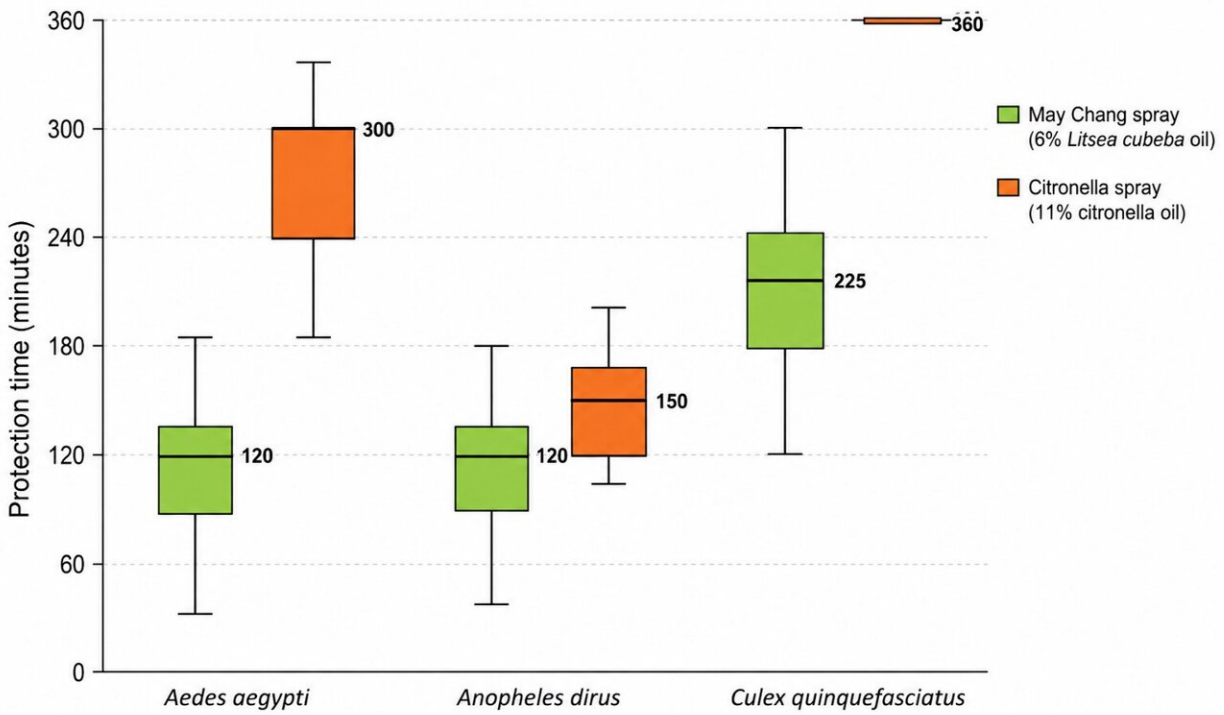
According to a study published in *Scientific Reports*, a spray that contained 6% oil of the May Chang tree, known for its sweet fragrance, had the ability to effectively deter three important species of mosquitoes in a lab setting. Provided that it retains the same efficacy outside of the lab, the aromatic spray might be another way of using plants to keep away mosquitoes.

A fresh contender against mosquitoes

May Chang (Litsea cubeba) is an aromatic shrub originating from Southeast Asia. The essential oil obtained from the plant, which is high in citral and fragrant, has long been known to repel insects.

The study group invented a ready-to-use spray for the skin called MosShield, which contains 6% May Chang oil and standard cosmetic ingredients. The formulation's quality was confirmed, and a skin-patch test was performed to assess its short-term dermal tolerability on 48 healthy adult volunteers.

Patches of MosShield were placed on their arms, which the team studied after half an hour, 48 hours and 96 hours. No symptoms (irritations or lesions) appeared in volunteers after 96 hours. The authors wrote, "No dermal irritation was observed in the short-term skin-patch test." This finding instilled confidence in the initial skin sensitivity of the formulation and gave a strong basis for extensive testing.



Box-and-whisker plots comparing the complete protection times of the May Chang-based MosShield spray (6% Litsea cubeba oil) and an 11% citronella spray against three mosquito species. Credit: generated by AI using data from *Scientific Reports* (2026). DOI: 10.1038/s41598-026-61769-z

Arm-in-cage showdown

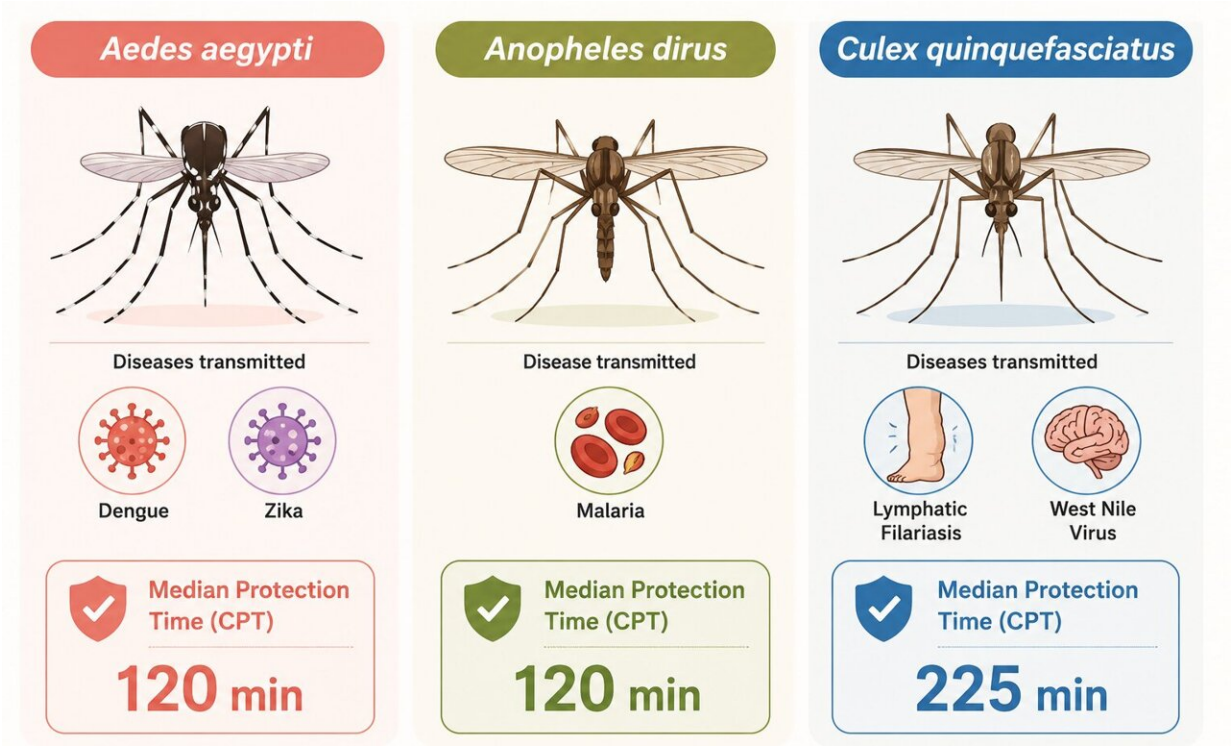
Following the standard WHO arm-in-the-cage protocol, the volunteers sprayed the MosShield onto their arms and placed it into a cage containing hungry females of three key mosquito species. Those were Aedes aegypti (the dengue-and-Zika mosquito), Anopheles dirus (a malaria vector), and Culex quinquefasciatus (a common house mosquito that transmits West Nile virus).

In each test, the total time from spray application until a second mosquito landed or attempted to bite the treated skin was measured. This duration is defined as the "complete protection time" (CPT), and it becomes critical to consider due to the especially difficult test conditions where mosquitoes were strongly motivated to locate their hosts.

Depending on the species, the efficiency of the spray varied. In terms of preventing Culex mosquitoes, the MosShield formula worked the longest, with a median of 225 minutes, which was almost 3.8 hours. Aedes and Anopheles stayed away for about 120 minutes each, or 2 hours.

Notably, this number coincides with the laboratory threshold for protection against Aedes aegypti in Thailand. The May Chang formula reached the 2-hour protection standard from Thailand against dengue mosquitoes.

The authors note, "The formulation provided measurable repellency against three medically important mosquito species." Essentially, two hours certainly isn't a record, yet it is a good performance for an herbal repellent on skin.



Median complete protection time (CPT) of the 6% May Chang (Litsea cubeba) spray against three medically important mosquito species, alongside the major diseases they transmit. Credit: generated by AI using data from *Scientific Reports* (2026). DOI: 10.1038/s41598-026-61769-z

Citronella sets the bar

Any promising new repellent also has to measure up against products already on the market. The researchers used the Soffell Spray Natural, which contains 11% citronella oil, a commercially available citronella-based repellent, to evaluate their new spray's efficacy.

One of the most well-known botanicals used in natural mosquito repellents is the oil extracted from the Cymbopogon grasses, commonly known as citronella. This was thus a practical standard against which to

assess the May Chang formulation.

In the same WHO test, citronella spray was much more protective than MosShield. It offered complete protection against Culex mosquitoes for the entire 360-minute observation period, against Aedes mosquitoes for approximately 300 minutes, and against Anopheles mosquitoes for 150 minutes.

May Chang spray provided inadequate protection time against all three species. Although it met Thailand's laboratory efficacy criteria for Aedes aegypti, the findings do not imply it performs better than current botanical repellents.

From cage to the field

It's important to remember that this was a controlled lab study. Colony mosquitoes were used in all trials under laboratory conditions differing from field populations. As observed in the paper, these laboratory findings indicate the need for further investigation of the 6% L. Cubeba spray anti-insect tests conducted in gardens.

There are a few more limitations to be mentioned, such as the patch test being short in young, healthy adults (no long-term skin safety data yet) and the fact that the exact MosShield recipe is a trade secret, so we don't know which ingredient does the heavy lifting. The scientists also did not analyze precisely how the oil works at the molecular level—though earlier work suggests essential oils like Litsea cubeba "interfere with mosquito orientation to host-associated cues."

The concept is attractive nonetheless. If proven effective and safe, a lemon-scented mosquito spray may soon be available as a personal mosquito repellent. MosShield, according to the authors, showed "measurable repellency" against dengue, malaria, and West Nile

mosquitoes with "no visible dermal irritation."

Nevertheless, it hasn't yet been proven to prevent disease in the real world—that would take field studies on bitten people. The bottom line: A May Chang spray shows lab promise as a plant-based repellent, but more work is needed to see if it can really protect campers or villagers from bites and illness.

More information: Nataya Sutthanont et al, Topical mosquito repellency of a Litsea cubeba essential oil spray against Aedes aegypti, Anopheles dirus, and Culex quinquefasciatus, *Scientific Reports* (2026). DOI: 10.1038/s41598-026-61769-z

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