

## Benefits of repelling rather than killing insects

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As the days get longer and the weather warms up, many of us venture out from our homes to enjoy the outdoors, flocking to beaches, parks or even mountain trails to spend time with friends and family, especially now with Covid restrictions having been greatly relaxed.

However, just as we venture out of our homes to enjoy the sunshine, so too do seasonal pests. Mosquitoes, ticks and midges are all incredibly active during the summer months and, as temperatures continue to rise as a result of climate change, it may be that we start seeing these seasonal pests for longer periods of time, or in areas where they were not previously seen.

By now, with the overwhelming amount of research available with one quick search, we are all well-aware of the dangers of insect bites. At the best of times, they can be annoying and itchy, located in the most inconvenient areas. Those unlucky enough to be allergic to said bites can also experience swelling at the site, or even infections due to the constant itching. Importantly, though, these small bites can also pose serious health risks, as some insects are vectors (carriers of harmful diseases) which can be transferred to humans through the bite site.

Ticks, commonly found in grassy and woodland areas, bite and burrow into the skin, releasing the bacterium *Borrelia burgdorferi* into a host's bloodstream. In the host body, this can develop into Lyme disease or the Rocky Mountain spotted fever. Mosquitoes, on the other hand, have been called the most 'dangerous' insects on the planet and are responsible for over 4 million deaths per year due to Malaria alone, though they also transmit other diseases such as Zika, Dengue and the West Nile virus, which can all lead to serious illness and even death.

In order to reduce the likelihood of coming into contact with these illnesses, it is important to protect ourselves against insect bites. Preventing insect bites can be done in two main ways – either through killing the insect (using products called insecticides) or by discouraging insects from landing on skin, by using insect repelling products which mask the cues that insects use to locate hosts.

'Insecticide' is the general term used to describe pesticides that are specifically designed and used to kill insects. There are multiple types of insecticide, which work in different ways. Some are toxic to insects upon direct contact (meaning the insect needs to make physical contact with the insecticide for it to work), whereas other forms of insecticide are ingested by the insect and impair their nervous system, disabling and eventually killing the insect. Examples of insecticides include products such as insect 'zappers' (a device that attracts and kills flying insects attracted to

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light), or DDT (a type of organochloride) which opens sodium channels in an insect's nerve cells.

On the other hand, non-insecticidal (repellent) products work by repelling insects instead of killing them (i.e. by preventing them from finding exposed skin on which they might land). In order to locate a potential host (such as humans, rats, deer, dogs, horses etc), insects like mosquitoes and ticks use cues, such as carbon dioxide produced on exhalation, body heat or movement. Repellents deter insects from biting an individual who has taken precautions, but they do not completely eliminate the risk of disease. Since the insect has not been killed, it could still detect - and infect - other hosts and so still pass on disease.

As tempting as it may be to reach for insecticide sprays (e.g. DDTs, permethrin or malathion) in order to ward them away from the home, eliminating any insects that come close is neither necessary nor effective and often causes more harm than good. There are multiple reasons to avoid insecticides and instead opt for repellent sprays (especially naturally sourced insect repellents) which are much more environmentally (and skin) friendly.

One benefit to using insect repellents is that they are much more species specific. As annoying as they are, it is important to remember that not all mosquitoes carry harmful diseases. In fact, out of the 3,500 species of mosquito on the planet, only a mere 6% (around 100 species) feed on humans and of these 100 species it is only the females who take blood meals, as they require protein for their eggs. Most mosquito species are pollinators and do not take blood meals. Similarly, ticks and midges are important food sources for reptiles, bats, birds and amphibians. Using insect repellent can target those specific female mosquitoes, ticks and midge species attracted to human blood, while avoiding interference with the behaviour of beneficial insects. However, since insecticides work on any insect that lands on, or ingests, said insecticide, they are said to be non-specific. Though this makes them very efficient at killing harmful insects like mosquitoes and ticks, it also means that they will kill useful insects such as spiders, moths and bees which are vital to the ecosystem and typically harmless to humans.

Another issue with using insecticides is that continued use leads to the development of insect resistance. When an insecticide is sprayed, not all the insects exposed will die as some may have a genetic mutation which allows them to survive. These insects will be able to reproduce and pass on their mutation to offspring, who will then also be resistant. Continued spraying of the insecticide can actually result in a reduction in the effectiveness of the insecticide. In contrast, because repellents work by affecting an insect's ability to detect a host rather than killing the insect, there is no biological incentive for the insect to mutate (it simply waits to find an alternative blood meal never even being aware of the person wearing repellent), and hence no resistance to the repellent develops.

A third benefit of using insect repellent is that it does not require the insect to touch or ingest it in order to work. Consider plants that are sprayed with insecticides,



or an insect who has died due to insecticide. This plant or insect may be eaten by another organism and then that organism is eaten by another and so on. In this way, the chemicals can be passed up the food chain. Animals at the top of the food chain (e.g. humans, birds, etc) face a greater risk of toxicity from the build-up of insecticide chemicals within their system. Though this problem is beginning to be addressed (insecticides are legally required to break down more quickly in order to avoid this accumulation of toxicity), this problem is avoided completely by using insect repellents instead.



Using insecticides to protect ourselves from insect bites and insect-borne diseases is not a sustainable practice. Insecticides pose a risk to many species (including those that are beneficial in the ecosystem) and can be problematic in the long term, leading to resistance and accumulation. By using insect-repelling products instead, we are able to avoid the issues that insecticides pose, whilst still preventing insect bites that are often painful and can lead to disease transmission.

Insect repellents have the added benefit of being gentle on skin and some natural products, like Oil of Lemon Eucalyptus (or Eucalyptus citriodora oil, hydrated, cyclized), can even be used on children and pregnant women to prevent bites. A recent decision by USEPA specifically concluded after its 2019 review of new OLE safety data that there is no endpoint of concern for dermally applied products and hence even the highest concentration of OLE products on the US market could be applied in accordance with label instructions to children of all ages. These plant-based insect repellents are also more environmentally friendly. They rely on an essential oil which is already part of the earth's ecosystem as their source material, rather than introducing a purely synthetic chemical into the environment. So, wherever you venture out to this summer, by using botanically sourced insect repellents, you can rest assured knowing that you are contributing to a healthy environment, whilst at the same time ensuring your family will be well protected.

