Researchers discover how a bio-pesticide works against spider mites

January 6 2021

Scientists have uncovered why a food-ingredient-based pesticide made from safflower and cottonseed oils is effective against two-spotted spider mites that attack over a thousand species of plants while sparing the mites' natural predators.

An international team of scientists has uncovered how a bio-pesticide works against spider mites while sparing their natural predators.

The findings, published in the journal *Engineering in Life Sciences* on October 7, 2020, could present farmers and gardeners with an eco-friendly alternative to synthetic pesticides.

Food ingredients have long been used as alternative pesticides against arthropod pests, such as insects, ticks, and mites, because they tend to be less toxic to mammals and pose less impact to the environment. The way bio-pesticides work—often through physical properties instead of chemical ones—also reduces the likelihood that the targeted pest will develop resistance to the pesticide, in turn reducing the need to use greater quantities of the pesticide or develop new ones.

One such bio-pesticide, made from safflower and cottonseed oils—which takes the brand name Suffoil—has been known to be effective against two-spotted spider mites (*Tetranychus urticae*), a species of arachnid that attacks more than 1,100 species of plants. Suffoil has no effect on another species of mite (*Neoseiulus californicus*) that naturally preys on the spider mite.

A spider mite normally hatches by cutting the eggshell, or 'chorion,' with its appendages as it rotates in the egg. The rotation in turn helps it cut more of the chorion and eases hatching. The spider mite embryo also uses silk threads surrounding the eggs, woven by its parent to house the eggs on the underside of leaves, which may act as leverage to aid this rotation.

To understand how Suffoil works against spider mites, the researchers dipped spider mite eggs in Suffoil and examined them using powerful microscopes. They also used spider mite eggs dipped in water as a control group.

They found that Suffoil partly covered the surface of spider mite eggs and the surrounding silk threads. More importantly, they observed that the embryonic rotational movement essential for hatching was absent or stopped in the Suffoil-covered eggs. It appears that the oil seeps into the eggs through the cut chorion, making the inside too slick for the embryo to rotate, thus preventing the embryo from hatching properly.

"The bio-pesticide works by preventing the spider mite embryo from rotating within its eggshell for hatching," said Takeshi Suzuki, a bio-engineer at Tokyo University of Agriculture and Technology (TUAT) and senior author of the study.

"It may also weaken the toughness of silk threads and reduce the anchoring effect of the egg on the substrate," said Suzuki.

The findings also offer an explanation as to why Suffoil has no effect on the spider mites' natural predators—they don't use rotation to hatch out of their eggs. This means that Suffoil may be used in conjunction with the spider mites' natural predators.

More information: Naoki Takeda et al, A vegetable oil–based

biopesticide with ovicidal activity against the two-spotted spider mite, Tetranychus urticae Koch, *Engineering in Life Sciences* (2020). DOI: 10.1002/elsc.202000042

Provided by Tokyo University of Agriculture and Technology