

How the humble marigold outsmarts a devastating tomato pest

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The Tomato, (*Lycopersicon lycopersicum*) flowering, associated with a young, developing fruit. Credit: Earth100/Wikipedia

Scientists have revealed for the first time the natural weapon used by marigolds to protect tomato plants against destructive whiteflies.

Researchers from Newcastle University's School of Natural and Environmental Sciences, carried out a study to prove what gardeners around the world have known for generations—marigolds repel tomato whiteflies.

Publishing their findings today in the journal *PLOS ONE*, the experts have identified limonene—released by marigolds—as the main component responsible for keeping tomato whiteflies at bay. The insects find the smell of limonene repellent and are slowed down by the powerful chemical.

Large-scale application

The findings of the study have the potential to pave the way to developing a safer and cheaper alternatives to pesticides.

Since limonene repels the whitefly without killing them, using the chemical shouldn't lead to resistance, and the study has shown that it doesn't affect the quality of the produce. All it takes to deter the whiteflies is interspersing marigolds in tomato plots, or hang little pots of limonene in among the tomato plants so that the smell can disperse out into the tomato foliage.

In fact, the research team, led by Dr. Colin Tosh and Niall Conboy, has shown that may be possible in to develop a product, similar to an air freshener, containing pure limonene, than can be hung in glasshouses to confuse the whiteflies by exposing them to a blast of limonene.

Newcastle University Ph.D. student Niall said: "We spoke to many gardeners who knew marigolds were effective in protecting tomatoes against whiteflies, but it has never been tested scientifically.

"We found that the chemical which was released in the highest

abundance from marigolds was limonene. This is exciting because limonene is inexpensive, it's not harmful and it's a lot less risky to use than pesticides, particularly when you don't apply it to the crop and it is only a weak scent in the air.

"Most pesticides are sprayed onto the crops. This doesn't only kill the pest that is targeted, it kills absolutely everything, including the natural enemies of the pest."

Limonene makes up around 90% of the oil in citrus peel and is commonly found in household air fresheners and mosquito repellent.

Dr. Tosh said: "There is great potential to use limonene indoors and outdoors, either by planting marigolds near tomatoes, or by using pods of pure limonene. Another important benefit of using limonene is that it's not only safe to bees, but the marigolds provide nectar for the bees which are vital for pollination.

"Any alternative methods of whitefly control that can reduce [pesticide use](#) and introduce greater plant and animal diversity into agricultural and horticultural systems should be welcomed."

The researchers carried out two big glasshouse trials. Working with French marigolds in the first experiment, they established that the repellent effect works and that marigolds are an effective companion plant to keep whiteflies away from the [tomato plants](#).

For the second experiment, the team used a machine that allowed them to analyse the gaseous and volatile chemicals released by the plants. Through this they were able to pinpoint which chemical was released from the marigolds. They also determined that interspersing marigolds with other companion plants, that whiteflies don't like, doesn't increase or decrease the repellent effect. It means that non-host plants of the

whiteflies can repel them, not just marigolds.

A notorious pest

Whitefly adults are tiny, moth-like insects that feed on plant sap. They cause severe produce losses to an array of crops through transmission of a number of plant viruses and encouraging mould growth on the plant.

Dr. Tosh said: "Direct feeding from both adults and larvae results in honeydew secretion at a very high rate. Honeydew secretion that covers the leaves reduces the photosynthetic capacity of the plant and renders fruit unmarketable."

Further studies will focus on developing a three companion plant mixture that will repel three major insect pests of tomato—whiteflies, [spider mites](#) and thrips.

Longer term, the researchers aim to publish a guide focussing on companion [plants](#) as an alternative to pesticides, which would be suitable across range of horticultural problems.

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