

Lack of 'happiness' hormone makes rice plants less attractive to insects

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Inhibiting the production of the 'happiness' hormone – serotonin – in rice plants, increases their resistance to two of the world's most destructive and costly insect pests, new research has shown.

The study, published this week in *Nature Plants*, shows that by suppressing the production of serotonin, [rice plants](#) become more resistant to their two most serious predators – the brown plant-hopper and the striped stem borer.

Using gene editing techniques on [rice](#) plants to switch off the serotonin-producing gene, the team found the plants also produced higher levels of salicylic acid – a chemical similar to aspirin.

Conversely, adding serotonin to the resistant rice led to a loss in insect resistance.

Important role played by serotonin in plant defence

Led by experts from Newcastle University, UK, and Zhejiang University, China, the team says these new findings demonstrate the important role that serotonin plays in plant defence and opens up new

opportunities for breeding insect-resistant varieties of rice and other cereal crops.

Professor Angharad Gatehouse, co-author on the study and a Professor of invertebrate molecular biology at Newcastle University, explains:

"Recent research has suggested that, even though they lack a nervous system, plants are much more responsive to their surroundings than was previously thought.

"This example shows how the same chemicals that modify behaviour in animals can be used to regulate [plant defence](#) against [insect pests](#) and is another reminder that all living organisms have more similarities than differences at a basic level."

Primary pests in rice crops

Rice is one of the world's most important foods and the brown plant-hopper and striped stem borer are the two most serious pests in rice production causing losses of billions of dollars.

The plant hopper is a sap-sucking [pest](#), which transmits plant viruses, as well as causing "hopper burn" where blockage of the water-carrying vascular tissue causes plants to wilt and die causing significant yield loss.

The borer is a chewing insect which feeds on young plants causing 'dead hearts' and 'white heads' and again resulting in significant yield losses.

"Indiscriminate use of chemical pesticides has resulted in these two pests becoming increasingly difficult to control," explains Professor Gatehouse.

"The development of insect-resistant rice varieties is seen as a viable and ecologically sustainable approach for controlling these devastating insect pests."

Serotonin—mood regulator and appetite booster

Serotonin is ubiquitous across all forms of life and in mammals it is an important neurotransmitter.

In humans, serotonin helps to regulate mood, boost our appetite, regulate digestion and helps with sleep and memory.

In plants, serotonin is involved in growth and development, while in insects it is used to seek out resources and food.

Analysing the plant's response to insect attack, the team found both serotonin and salicylic acid were produced in response to an infestation but suppressing serotonin production made the rice [plants](#) more pest-resistant.

And by disabling the gene responsible for making [serotonin](#), the team were able to further increase levels of [salicylic acid](#) in the plant and increase its resistance.

More information: Hai-ping Lu et al. Resistance of rice to insect pests mediated by suppression of serotonin biosynthesis, *Nature Plants* (2018). [DOI: 10.1038/s41477-018-0152-7](#)

Provided by Newcastle University

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