

Aphids make 'chemical weapons' to fight off killer ladybirds

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Cabbage aphids have developed an internal chemical defence system which enables them to disable attacking predators by setting off a mustard oil 'bomb', says new research published today.

The study shows for the first time how aphids use a chemical found in the plants they eat to emit a deadly burst of mustard oil when they're attacked by a predator, for example a ladybird. This mustard oil kills, injures or repels the ladybird, which then saves the colony of aphids from attack, although the individual aphid involved usually dies in the process.

When the aphids feed on cabbages, they consume chemicals called glucosinolates which are found in the nutrient transport vessels of the plant. Once eaten, these chemicals are then stored in the aphids' blood. Mimicking the plants themselves, the aphids also produce an enzyme called myrosinase, which is stored in the muscles of their head and thorax. In the event of a predator attack this enzyme in the muscles comes into contact with the glucosinolates in the blood, catalysing a violent chemical reaction which releases mustard oil.

The research team from the UK and Norway confirmed their findings by controlling the diet of different groups of aphids. They found that those insects eating a diet rich in glucosinolates had a high success rate in fending off predators, whereas those without glucosinolates in their diet did not. Scientists already knew that aphids absorbed these chemicals from their food, but this study published *Proceedings of the Royal Society*

B is the first of its kind to prove that they form the basis of a chemical defence system.

The scientists also found that the extent to which glucosinolates are stored up by the aphids from birth into adulthood depends on whether or not they develop wings. Those aphids that grow wings see a rapid decline in the amount of glucosinolates they store from the time wing buds start to develop.

Dr Glen Powell from Imperial College London's Division of Biology, one of the paper's authors, explains: "Our study seems to show that aphids that develop wings cease to store this chemical in their blood as they mature, as they don't need the 'mustard oil bomb' to defend themselves from predators when they can just fly away. This is a great example of the way in which a species provides an ingenious method of protecting itself, whatever the circumstances."

Dr Powell adds: "In the wild, aphids live in clonal colonies, with often many hundreds of individuals crowded together on a plant, and using this poisonous mustard oil defence provides wingless individuals with a powerful means of dispelling a predator which poses a risk to the entire colony. Unfortunately the nature of the mechanism – with the chemical stored in the insect's blood and the catalyst stored in its muscles – means that in most cases the individual aphid responsible for seeing-off the ladybird predator dies in the process of protecting the colony."

Source: Imperial College London

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