

Mustard plants have double defence against insect pests

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Mustard plants have a double line of defence against foraging insects. The plants can release odours to attract miniscule wasps, which parasitise insect pest eggs. However, mustard plants also react by allowing cells to die, so the deposited eggs of harmful insects drop from the plants. Until recently these were believed to be two conflicting defence mechanisms, but research performed by Wageningen entomologists has shown that the mechanisms actually reinforce each other.

The researchers have published an account of their findings – that up to 80% of butterfly [eggs](#) die as a result of the double line of defence in mustard plants – in the August issue of the scientific journal *Proceedings of the Royal Society B*.

Plants can protect themselves against insects in a remarkable way, even before the insects do any damage. When the small cabbage white butterfly lays its eggs on a black [mustard plant](#) (a member of the cabbage family), a programmed 'cell death reaction' to the butterfly eggs occurs. The plant cells beneath and around the eggs die and drop from the plant, so no more voracious caterpillars can hatch out. If this direct [defence mechanism](#) fails to work, the mustard has a second (indirect) line of defence. Plant odours attract miniscule ichneumon [wasps](#) that parasitise the eggs. These wasps lay their own eggs in the butterfly eggs, which the developing ichneumon wasp larvae subsequently consume.

Parasitic wasps

Until recently, these two forms of plant defence were thought to be in conflict with each other because the ichneumon wasps could not possibly develop fully in eggs that are destined to be victims of programmed cell death. Now, Fatouros and her colleagues reveal in *Proceedings of the Royal Society B* that the parasitic wasps are not affected by the other form of defence. They can develop just as well on both types of mustard plant: those with and those without the direct defence line involving sacrificed plant [cells](#). The researchers were surprised to find that the [odours](#) released by plants with a direct line of defence are even more attractive to wasps; there are often more of the parasitised eggs on those plants than on plants lacking the direct defence mechanism. The double line of defence results in the death of up to 80% of butterfly eggs. In other words, the two types of plant defence mechanism are not in conflict. However, not all mustard plants in the population deploy a direct method of defence against eggs. This is a subject for future investigation, Fatouros and her colleagues believe.

More information: Fatouros, N. E., Pineda, A., Huigens, M. E., Broekgaarden, C., Shimwela, M. M., Figueroa, I. A., Verbaarschot, P. & Bukovinszky, T. (2014) Synergistic effects of direct and indirect defences on herbivore egg survival in a wild crucifer. *Proceedings of the Royal Society B: Biological Sciences*, 281, no.1789 20141254; [DOI: 10.1098/rspb.2014.1254](#)

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