

Anti-pest weapon deciphered

Plants develop all kinds of strategies for warding off pest insects. Some varieties of cabbage, for example, kill the part of the leaf where the cabbage white butterfly lays its eggs, as Niccolo Bassetti, a researcher at Biosystems, has shown. The egg then dies. Exit cabbage white.

Bassetti obtained a PhD earlier this month for his study of the genetic mechanism behind this localized suicide. The phenomenon itself has been known to scientists since the 1980s. Varieties of cabbage exhibit necrosis (cell death) at places where cabbage whites have laid eggs.

Many cabbage plants use glucosinolates, the bitter substance in radish, rocket and cauliflower, as a defence against butterflies. To counter this, cabbage whites have developed the ability to break down this toxin. That puts the score at one all. But some cabbage plants went on to develop local necrosis. Bassetti's experiments showed that the wild black mustard plant is particularly good at this.

Cell death

According to Bassetti, it is not entirely clear how cell death causes the eggs to die. 'We think the eggs on the dead bit of leaf get dehydrated. We see them shrink. Another explanation is that the egg becomes misshapen because the leaf dries out. It is also possible that the necrosis releases substances that are toxic to the egg. Perhaps all of that goes on; biology is never simple.'

Bassetti looked for the genes in Chinese cabbage and black mustard that are responsible for the stimulated necrosis. In Chinese cabbage, three sites in the genome turned out to be involved, and they explained 30 per cent of the necrosis between them. The wild black mustard was a simpler case with only one site on the genome responsible for the defence response.

Escape routes

This piece of the genome consists of 11 genes. It is not yet clear which of the 11 genes is the real 'murder weapon'. Bassetti has a prime suspect but cannot name it because of an ongoing patent application.



Necrosis (cell death) on the spot where a cabbage has laid an egg.
♦ Photo Nina Fatouros

'You can insert this trait in plants for which the eggs are a big problem.' Arms proliferation, in other words, but all in a good cause.

A lot of cabbage species could benefit from such improved protection against the cabbage white. 'In crops, the necrosis response is very weak, whereas it is strong in wild black mustard. This kind of dif-

ference between crops and wild species is quite common. That is due to domestication: the necrosis response gets diluted in the selection for other properties. Modern genetics lets us restore that

response and increase genetic diversity.'

That puts the ball back in the butterflies' court. 'Some cluster their eggs, which results in fewer deaths,' says Bassetti. 'Our hypothesis is that they dry out more slowly. Some butterflies choose to lay the eggs on the flower rather than the leaf. A third option is to move house. That might be what happened with the black-veined white. It escaped the necrosis by changing host.' RRK

'Biology is never simple'