# Cabbage butterflies: smarter than you think

How does the common or cursed white cabbage butterfly, flitting around the garden, recognize a cabbage? By tasting the cabbage with sense organs on its feet, explains Dr Roger Traynier of the CSIRO Division of Entomology.

And with experience it learns what cabbages look like, at least to the extent of being able to pick their colour from a distance.

Dr Traynier has studied the learning ability of *Pieris rapae* (a butterfly, not a moth, as common usage is apt to put it) in his laboratory. His experiments reveal that the butterfly, despite smallness of brain, is not just a dumb creature, a blind follower of instinct. The females learn what's best to lay eggs on.

The butterfly's feet carry hairs that allow it to recognize chemicals in the foliage upon which it alights. If the leaf bears the magic chemical sinigrin — the 'active ingredient' — the excitement shows, and the taste is savoured by rapid foot scratching. The female has found her destiny, and she lays a single egg under the leaf.

She will then fly off and look for another cabbage, and another, until, within her life span — she's lucky to see out a month — she has laid several hundred eggs.

It's important that she doesn't lay her eggs on lettuces by mistake. Nobody's perfect, however, and sometimes she errs. Unfortunately, the caterpillars that hatch from such waywardness are fated to starve.

**Taught to associate the taste of cabbage with a green colour, cabbage butterfly number 10 lays eggs on green blotting paper.**

They, too, are programmed for sinigrin (and closely related chemicals).

These substances are found not only in cabbage. Other brassicas, garden nasturtiums, weld, and caper plants contain it as well, and each of these plants can serve as a host plant in *P. rapae*'s life cycle.

Once a female alights upon a sinigrin-flavoured leaf . . . aha! she learns something: cabbage is this colour. The next leaf she alights upon will, quite likely, be the same colour.

Dr Traynier has impregnated coloured discs of blotting paper with sinigrin solution and watched the egg-laying behaviour of captive, numbered, cabbage butterflies. He found that, at a sinigrin concentration of 10 p.p.m., he could teach butterflies to lay eggs on yellow, green, white, or pale blue discs, depending on the colour of the first sinigrin-doped disc.

However, cabbage butterflies do seem to prefer cabbage-like colours. They showed an innate aversion to red, purple, and dark blue. And so it is outside the laboratory: cabbage butterflies lay very few eggs on red cabbages, even though their caterpillars will thrive on these.

The advantage, to the butterfly, of this learning ability is that it can use sight to seek out host plants from some considerable distance. Some other butterfly species track down their host using odour, but this only works downwind, and can be disrupted by turbulence.

Dr Traynier's studies have also revealed other interesting information.

Once imbued with the taste of sinigrin, butterflies develop a stronger urge than before to lay eggs — partciularly on objects of their colour preference.

The heightened propensity to lay eggs remains as strong as ever after 3 days, even if no more sinigrin is to be found. (Butterflies 'remember', if you like, for at least this long.)

Like humans, butterflies make mistakes, but the greater the strength of the sinigrin they are exposed to when learning colour recognition, the less likely they are to go astray when seeking egg-laying sites.

The discovery that insects can learn introduces a new factor into entomology. It provides an explanation for earlier results that seemed paradoxical.

For example, in testing insects as biological control agents, laboratory experiments sometimes indicate that an insect will lay eggs on a far wider range of plants than it is found to do in the outside world.

The difference is that, in real life, the insect can, by 'comparison shopping', choose its host. It can learn to associate with its preferred one and to stay away from those that, in the laboratory, it may have been forced to live on.

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Long-term changes in the oviposition behaviour of the cabbage butterfly, *Pieris rapae*, induced by contact with plants.
R. M. M. Traynier. *Physiological Entomology*, 1979, 4, 87–96.