BACK BOX

Butterflies can leave a bad taste

A common crow caterpillar.

Not all butterflies are as innocent as they appear. For instance, those in the danaid family, which includes the familiar orange and black wanderer and the black-and-white common crow, thrive on the juices of poisonous plants such as ragwort, heliotrope, and crotolaria. They use the poisons — pyrrolizidine alkaloids — both as aphrodisiacs and to make their enemies sick.

The butterflies can't eat the plants directly, because they have sucking mouthparts for drinking the nectar of flowers. They rely on juices leaking from wilting leaves to get their alkaloid 'fix', or they may regurgitate liquid to soften a dead part of the plant and then drink the extract they have made.

Scientists have even observed them getting the poisons second-hand — by feeding on the juices of sick or dying grasshoppers that have accumulated the alkaloids.

The males of many danaid species deliberately seek out plants containing pyrrolizidine alkaloids because they require the toxins to make the pheromones they use to attract the female in courtship.

The pheromones are secreted onto small brushes called hairpencils, on the end of the male's abdomen. During courtship, the male brushes the hairpencils against the female's antennae and head in flight. She responds by alighting, and, after further 'hairpencilling', copulation takes place.

The common crow butterfly (*Euploea core corinna*) thrives on the juices of poisonous plants.

Although pyrrolizidine alkaloids form an essential part of the diet of some species to ensure that mating will occur, the male wanderer (*Danaus plexippus*) does not appear to need them for this purpose. Nor does 'hairpencilling' play an important part in his courtship.

Nevertheless, observers noted that male wanderers feed avidly on plants containing pyrrolizidine alkaloids.

This led Dr John Edgar, Mr Peter Cockrum, and Dr Les Frahn, of the CSIRO Division of Animal Health at Parkville, Vic., to suggest that the butterflies store the poisons as a protection against predators.

In one survey, they analysed wanderers caught at four different sites in South Australia. At three places, alkaloid-containing plants were growing and all the butterflies captured there contained the poisons. At the fourth site, neither plants nor butterflies contained alkaloids.

By feeding wanderers reared in the laboratory on an alkaloid–sucrose solution for 2 days and then on a sucrose solution alone for another 7 days, the researchers also showed that both male and female butterflies could store the poisons in their bodies. Control butterflies, fed on sucrose alone, were free of alkaloid.

Later, Dr Edgar had the opportunity to do chemical analyses on male and female danaids representing a further five African, six Solomon Island, and three Australian species. Only one species, from Africa, did not contain pyrrolizidine alkaloids.

Not surprisingly, danaids are unpalatable to most potential predators, which seem to remember the unpleasant after-effects of their dainty meal and avoid such insects in future. Previously, it was assumed that this was because the butterflies contained other poisons — cardiac glycosides — obtained from plants such as oleander, cotton bush, and rubber vine. But in the light of the CSIRO research, pyrrolizidine alkaloids may turn out to be equally, or even more, important.

Evidence that pyrrolizidine alkaloids stored by insects protect them from predators has come from the work of Dr Tom Eisner and his colleagues at Cornell University, U.S.A., working with the tiger moth *Utetheisa ornatrix*. Dr Eisner observed that tiger moths are rejected by certain orb-weaving spiders, which cut them from their webs rather than eat them.

The Cornell researchers have shown that the moths are unpalatable to spiders and to birds because of the pyrrolizidine alkaloids the caterpillars gather from their food plants. The spiders will eat moths from caterpillars reared on an alkaloid-free diet, but find even their palatable items, such as mealworms, unacceptable as food when alkaloids have been added.

Leigh Lehane

Pyrrolizidine alkaloid storage in African and Australian danaid butterflies. J. A. Edgar, M. Boppre, and D. Schneider. *Experientia*, 1979, 35, 1447–8.