Toxin clues to beetle relationships

Beetles are fascinating to evolutionary biologists because there are so many species that often occupy very specific niches. How did they get there?

A team led by Arnaud Termonia and researchers from the Free University of Brussels and the Smithsonian Tropical Research Institute in Panama have been looking for clues in a little-known group of tropical, leaf-eating beetles, *Platyphora* (Proc. R. Soc. B, Jan 2002).

Many organisms produce toxins in their body to deter predators and mostly they are made from scratch using basic ingredients, but some species sequester toxins from their food, notably amongst the insects.

But the *Platyphora* are distinctive in that every species in this very large group of beetles appears to be protected through sequestration of host-plant secondary metabolites and most show bold colour patterns telling potential predators of their toxins.

But use of host chemicals is no easy option: it is metabolically complex and limits insects to host plant species producing the relevant chemicals. So how do such beetles evolve to feed on other species?

The team found that while all the species used saponins sequestered from plant amyrins, some species also sequestered specific alkaloids from their host plants. The evidence suggested that this dual capability had evolved only once but was now found in a number of beetle species. The *Platyphora* group fed on members of only five plant families and just three of these produced the alkaloids found in some species.

The team then carried out DNA sequence comparisons between different species to determine their genetic relationships. Although the relationship between current species and their plant hosts was very conservative, the sequence evidence suggested that there had been six independent shifts between preferred host plant families during the evolution of the present group amongst those with dual defence mechanisms. It appears that sequestering two separate chemicals may provide a key evolutionary step to allow beetles to move from one host-plant to another.

Such evidence may throw light not only on the dynamics underlying the current conservative pattern of food preferences, but also on potential future changes too.

Toxin alert: Brightly coloured members of the *Platyphora* group of tropical leaf-eating beetles announce to predators their toxic defences. But researchers now believe sequestration of two plant toxins may help the beetles evolve new host plant preferences. (Photograph: Arnaud Termonia.)