Beetles and *Bobartia*

An interesting herbivore-plant relationship

by **Leigh-Ann R. de Wet, Nigel P. Barker and Craig I. Peter**, Botany Department, Rhodes University, Grahamstown

Bobartia orientalis (rush lily or blombiesie), a species in the Iridaceae family, is an endemic South African plant restricted to the Eastern and Western Cape, largely occurring within the Fynbos Biome. It is well known in the Eastern Cape where it causes problems for cattle farmers as it is tough and cattle avoid it, which leads to an increase in the population in overgrazed areas. *B. orientalis* is well adapted to the dry Eastern Cape and fire is thought to be important in its life history as woody rhizomes below ground are able to resprout after fire.

Bobartia orientalis flowers are yellow and densely clustered on the end of flower stalks. The main flowering season is from September to November but the plants may flower sporadically throughout the year, depending largely on rainfall. Flowering also relies on fire and plants may not flower if fire has not occurred. The fruit has three locules containing lots of red-brown seeds. *Bobartia orientalis* flowers co-occur with many other generalist flowers such as daisies and form an integral part of the floral landscape. An investigation of the flowers revealed that a wealth of herbivorous insects, including thrips and beetles, feed on the flower, and we found no less than thirteen different beetle species on them. Most interesting, however, was the prevalence of three bostrichoid beetles that feed on the inflorescences. This is unusual, as generally both the adults and the larvae of the Bostrichidae feed on wood or dry organic material.

BELOW: *Bobartia orientalis* (rush lily or blombiesie) has a rush-like growth habit and yellow flowers in densely packed inflorescences.

ABOVE: A variety of beetle species can be found feeding on the flowers of *Bobartia orientalis*, like this colourful chrysomelid beetle.

LEFT: Flower heads are produced every year. The old one on the right still has last year's dried fruit that splits open for the seeds to fall out.

A beetle study

We decided to examine populations of *Bobartia orientalis* in the Grahamstown area in order to clarify the relationships between three specific bostrichoid beetles and *B. orientalis* inflorescences. The three beetle species consist of two different species of adult beetles and a larval beetle that may or may not be the larval form of one of the two adult species. We could only identify the beetles to family level for the purposes of this study as there were no beetle experts familiar with these families around at the time.

In conventional herbivore-plant relationships, an increase in the abundance of the resource leads to a proportionally larger number of insects utilizing that resource. So the smaller and more dispersed the populations of the food plant utilized by a specific herbivore, the fewer herbivores per unit biomass occur within that population. Larger populations tend to have a disproportionately larger number of herbivorous insects. This is an easy relationship to explain, as the larger the populations of a plant, specifically when the main attractant is bright flowers, the more attractive the population. The usually airborne herbivores are able to locate the population easily and settle there to feed. In sparse, small populations, the attractant (usually flowers) is more difficult to locate and thus fewer herbivores settle there to feed.

Four sites were used for the study, each with varying densities of *Bobartia orientalis* plants from extensive, dense populations to sparse, diffuse populations. Inflorescences within these populations were harvested and examined for the presence of beetles in both the flowers and the fruits within the inflorescence head. The total weight of the potential food available (the inflorescences) was also recorded. The analysis concluded that although the big beetles are prolific within the *B. orientalis* inflorescences, they are largely just opportunistic herbivores that feed on the petals of the flowers. However, the large beetles may have a more meaningful relationship with *B. orientalis* as it is suspected that the larvae found in the fruits are in fact the larvae of this species.

Interestingly, the small beetles exhibit

what is termed a fine-grained distribution. This means that they utilize the food source evenly. The large populations have exactly the same concentration of beetles per unit biomass as the small populations. This suggests that the small beetle has a more complex relationship with *Bobartia orientalis* inflorescences than a simple herbivore-food source interaction. It seems that these insects may live and breed entirely within the inflorescences of *B. orientalis*. More work has to be done in order to determine whether this is indeed the case.

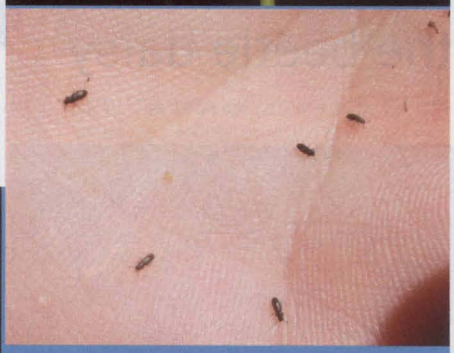
Looking at the larvae

The larvae also have an extremely interesting relationship with *Bobartia orientalis*. As mentioned already, *B. orientalis* has a trilocular fruit: the seeds are separated into three chambers within the fruit. Each of the three chambers is divided by a non-nutritive wall. Eggs are laid through the locules so that the larva hatches within one of the locules with the developing seeds, which it then eats. In all instances (twenty-one in our study) of larval infestation of fruits, only one larva was present in each fruit. In addition to this, none of the larvae had eaten through the interlocular wall to eat the seeds in the adjacent two locules of the infested fruit. It seems that the larvae only need the contents of one locule in order to reach pupation. In all locules where the seeds were completely eaten, the larvae had already pupated. This is indicative of a mutualistic relationship between the beetles and the *B. orientalis* fruit.

A similar occurrence has been noted in other plant species with loculate fruit and it is potentially a fairly common relationship. An example is that of the yucca moth and yucca plants where the moths actively pollinate the flowers by collecting pollen and placing it on the stigma. They then lay eggs in some of the locules of the ovary. By pollinating the flowers, they ensure a food source for the larvae and by not laying their eggs in all of the locules of the ovary, ensure the development of seeds in the plant. It would be more productive for the beetles if more eggs were laid on each fruit so that all the seed could be eaten. Instead, only one locule is consistently utilized as a food source. Some sources explain this in terms of the anatomy of the fruit. Apparently, often the interlocular walls within the fruit are too tough for to be chewed through to another side. It appears unnecessary for the larvae eating *B. orientalis* fruits to bite through into another locule as one is sufficient for it to reach the pupal stage.

Just the beginning...

This short study perhaps resulted in more questions than answers. We did uncover a very interesting relationship between the bostrichoid beetles and the inflorescences of *Bobartia orientalis*. It hints at the possibility of more specialized relationships between the beetles and the plants, both in terms of herbivory and perhaps potential pollination. This is important, as beetles are often overlooked when it comes to mutually beneficial relationships with plants, they tend to be characterized as destructive herbivores alone. Future studies aiming to clarify this relationship between beetles and *Bobartia orientalis* should provide fascinating results.



TOP: The flowers of *Bobartia orientalis* (rush lily or blombiesie) are densely packed in an inflorescence on top of a flower stalk.

ABOVE: Lots of these tiny bostrichoid beetles (about 2 mm long) were found in each flower head.

ABOVE: Larger bostrichoid beetles (about 5 mm long) were found feeding on the flowers.

BELOW: Bostrichoid beetle larva in one of the locules of the trilocular fruit of *Bobartia orientalis*.