Cotton predators exposed

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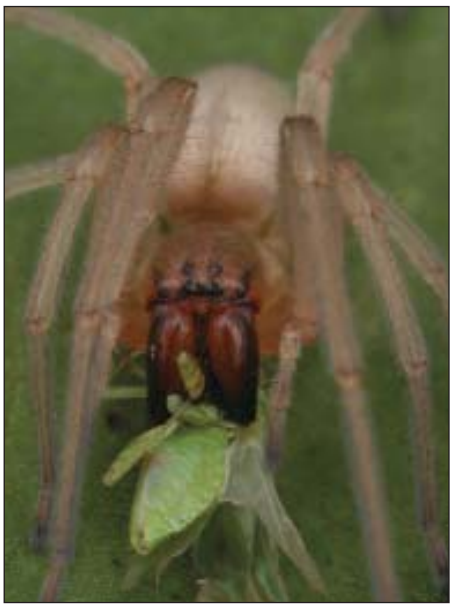
Cotton crops are happy hunting grounds for a number of predatory insects, many of which prey on eggs and larvae of Helicoverpa. This can cause significant mortality and reduce Helicoverpa numbers in the crops. Growers recognise the important role of the predators and are increasingly including considerations of predators in pest control decisions.

Agricultural practices can affect which predators are present as well as their interactions with their prey. The use of insecticides is one obvious example but other common practices such as soil cultivation can also affect predators.

In order to predict the impact of predators on Helicoverpa, it is necessary to understand both the effect of agricultural practices and predator behaviour, particularly what they are eating. The interaction between the availability of alternative prey and predation on Helicoverpa is also important.

This information, combined with improved monitoring methods and new technologies that help conserve predators (for example selective insecticides, Bt cotton and stubble retention), could greatly enhance the contribution of predators to management of Helicoverpa in cotton.



Yellow night stalker.

Measuring predation

In the cotton field, predation is difficult to measure because predators are often hard to see, secretive or nocturnal. Unless they are observed feeding upon a prey item, predators leave little trace of their activity. Direct observation can be useful but is a very time-consuming way of quantifying predator behaviour.

The development of techniques such as ELISA, which can detect proteins from prey species in a predator's gut contents, has made the task of assessing predation easier. The results from these tests provide a direct link between predator and prey.

Efficient, accurate methods to monitor the abundance of beneficial arthropods are also important, if predators are to be fully incorporated into grower pest management strategies. Dr Brad Scholz and colleagues (QDPI) have pioneered the use of

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a beatsheet to measure the populations of beneficial arthropods (*The Australian Cottongrower* Sept–Oct 2001 pp 14–17).

The research

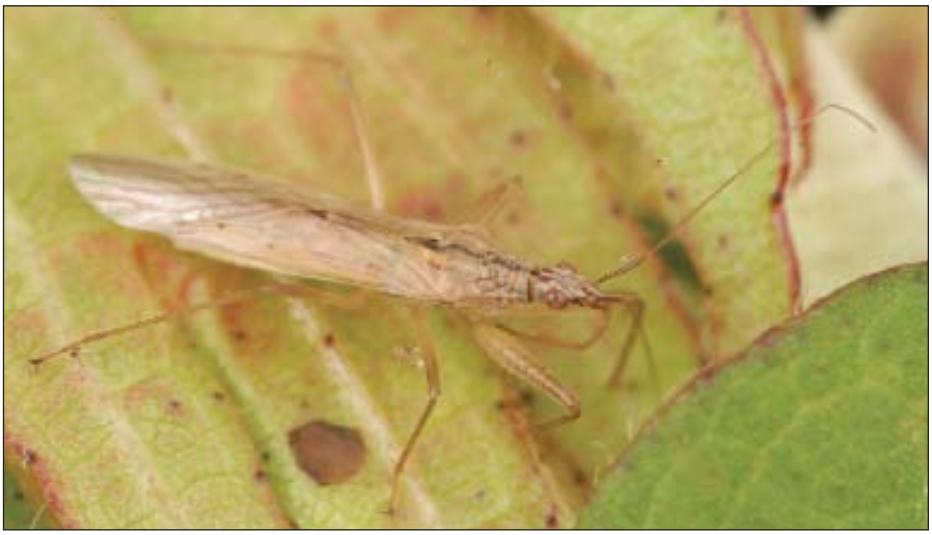
Dr Sarah Mansfield (Australian Cotton CRC, CSIRO Entomology) investigated what impact insect predators have on Helicoverpa in cotton and explored the interactions between predator abundance, agronomic practices and predation of Helicoverpa eggs and larvae. The key beneficial groups investigated were predatory beetles, predatory bugs and ants.

Several strategies were used to determine the importance of different insect predators in cotton:

- Manipulative experiments;
- Direct monitoring of insect abundance in commercial cotton crops;
- Observation of predator behaviour under natural conditions; and,
- Development of diagnostic laboratory tests (ELISA) to detect recent consumption of *H. armigera* by predators.

The predators

The bigeyed bug (*Geocoris lubra*) and damsel bug (*Nabis kinbergii)* were significant predators of *H. armigera* in cotton crops during seasons of both low and high



Damsel bug.

H. armigera abundance. Over two consecutive cotton seasons (2001–02 and 2002–03), 13 per cent of big eyed bugs and 25 per cent of damsel bugs tested positive for recent predation on *H. armigera* using ELISA.

Damsel bugs feed on a range of prey, not just *Helicoverpa spp*. So damsel bugs can maintain populations within the cotton system even when Helicoverpa are less abundant. Under laboratory conditions, juvenile big eyed bugs survive and develop better on a diet of *H. armigera* compared with a diet of aphids . This suggests that *H. armigera* is an important food source for this predator. Warm temperatures (above 27°C) favour breeding of this species.

Two other predatory bugs (the brown smudge bug, *Deraeocoris signatus* and minute pirate bugs, *Orius spp*.) often become abundant in late season cotton crops, but the impact of these predators on *H. armigera* is not yet known.

Although the predatory red and blue bee-

tle (*Dicranolaius bellulus*) was highly abundant in both the 2001–02 and 2002–03 seasons, only one per cent tested positive for recent predation on *H. armigera*. But the diagnostic ELISA test is less effective with predatory beetles than predatory bugs, so these results may underestimate the rate of predation for this species.

Most species of native ladybirds found in Australian cotton crops feed primarily on aphids but may feed on *H. armigera* in the absence of their preferred prey.

Early in the growing season, ants (*Pheidole* and *Iridomyrmex spp*.) were observed to prey upon *H. armigera* eggs in small quantities. Cultivation and flood irrigation severely disrupt ant populations in cotton crops and limit their impact as predators. Dryland cotton may support a greater diversity of ants in the absence of cultivation or insecticide effects, although this needs to be confirmed by further research. Minimum tillage combined with a cotton/wheat rotation can increase ant abundance relative to other cultivation systems.

Some spiders commonly found in cotton crops, such as the yellow nightstalker (*Cheiracanthium spp*.), are also likely to feed upon Helicoverpa but their impact on *H. armigera* was not specifically addressed in this project.

It is important to know which species of predators are in the crop.

What affects predators?

Insecticide use remains the key factor affecting the abundance and diversity of beneficial arthropods in Australian cotton crops. When a soft insecticide regime is used, the abundance of beneficial arthropods increases dramatically over the course of the cotton season, with the growth of the crop canopy.

Bt cotton crops usually support a greater abundance of beneficial arthropods compared with conventional sprayed cotton crops. But it is not yet clear if this difference is solely attributable to the softer insecticide regime typically applied to these crops.

This research has provided an improved understanding of predator–prey interactions and has demonstrated that predatory bugs are key predators of *H. armigera*.

These results should increase grower confidence in the importance of beneficial arthropods, particularly predatory bugs, for the control of *Helicoverpa armigera*.

When growers make pest management decisions, they need to consider not only the total abundance of beneficial arthropods within their crops, but also which species are present. Not all beneficials have an equal impact on Helicoverpa. While such considerations increase the complexity of crop management decisions, in the long term a deeper understanding of the beneficial community should improve pest control and increase the sustainability of the cotton industry.

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