PREDATORS MAKE BIG SCREEN DEBUT

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Over the years, researchers have invested considerable effort in studying predators of helicoverpa. Most attention has focused on what eats eggs and small larvae, life stages where high mortality is often observed. The outcome from these studies is the identification of several key predators. Growers and consultants are now doing much more to conserve these predators than in the past. Transgenic Bt cotton has greatly reduced overall insecticide use, and for conventional cotton, more selective insecticides are increasingly used.

Knowing what happens to large helicoverpa larvae has proven much more challenging than for earlier life stages. When large larvae have finished feeding on the crop, they drop to the ground and wander over the soil surface searching for a suitable site at which to burrow down and pupate. Larvae are vulnerable to predation during this period of wandering, but a damsel bug or red and blue beetle is no match for this formidable opponent, which can defend itself with aggressive movements and strong mandibles.

What happens to large larvae?

In studies on the Darling Downs, we often observed high densities of large larvae in fields, only to find low numbers of pupae in these same fields during subsequent pupal surveys. This prompted the question – what happens to them?

There are scattered reports documenting predators tackling large larvae. These include mice, birds, carabids (predatory beetles), predatory earwigs and spiders.

The dearth of studies investigating this life stage probably reflects the difficulty of the task. Visual observation methods normally used to record predation were not suitable for these studies. Firstly, the presence of human observers could interfere with the behaviour of predators. Secondly, because most of the action is at night, observers need special optical devices e.g. night vision glasses, that were not available to us. Thirdly, we didn’t quite have the inclination to sit out all night, night after night, to observe what was going on. Given this challenge, we set about developing a video surveillance system to help understand what happens in fields at night, when most of us are cosily tucked away in bed.

Video surveillance

Four digital surveillance cameras with infra-red lighting were set up to record night feeding on helicoverpa at seven Darling Downs sites of rain-grown crops of maize, mungbeans, sorghum and cotton. Studies were carried out in these crops at a stage of development when larvae would normally mature and move to the ground to pupate.

Each camera focused on a 0.5 x 0.5 m patch of ground adjacent to the plant row. The four cameras were connected to a 4-channel digital recorder which captured one frame every second. The sequence was stored on an 80 GB removable hard disk drive that was later viewed in the lab. The recording system was powered by solar panels and rechargeable batteries.

Tethered prey
Because natural prey were not abundant, the trials involved tethering large helicoverpa larvae to small metal pegs within the area covered by the cameras. For each camera, five mature helicoverpa larvae were placed in the field at sunset, with the studies repeated over two consecutive nights at each site. We used braided fishing line to tether larvae as preliminary studies showed larvae chewed through cotton thread in a matter of minutes.

Active predators
The cameras caught several species of frogs, mice, two species of carabid beetles, predatory earwigs and centipedes eating large helicoverpa larvae. Predator activity, as determined by recorded presence in the viewing area, continued through the night, even after the tethered prey were consumed (Figure 1).

The five larvae put out below each camera at sunset often disappeared within two hours or sooner. From a total of 280 tethered larvae, none survived through the night to see sunrise the next day.

While mice did not remain in the viewing area for long periods of time, they were very efficient predators compared to other species (Figure 2).

The abundance and diversity of these predators varied greatly across sites. At one site in particular, two species of carabids were very abundant and actively competed with mice for prey. Mice invariably won the contest. In a recorded interaction between a carabid and a predatory earwig, the earwig took the spoils of the contest.

As a result of these studies, we have identified several important predators of large larvae in raingrown cropping situations. These data provide some interesting insights into what are some potentially valuable contributions by ground predators.

The data also pose plenty of questions. Are these predators as abundant in irrigated fields compared to dryland fields? Can we enhance activity of these predators in fields? Will these predators be efficient enough to detect and kill survivors in Bollgard II fields and assist resistance management? These topics could be the focus of future investigations.

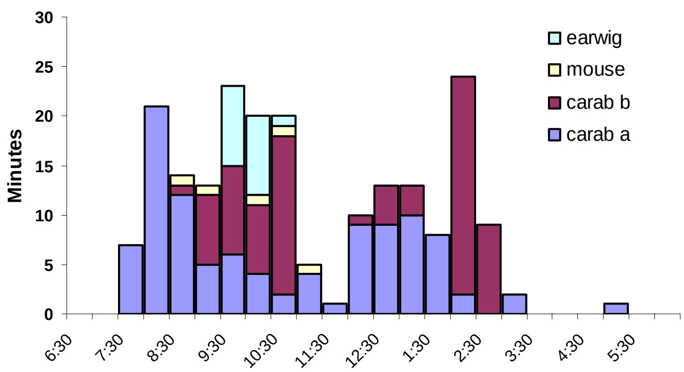
***Queensland DPI&F and Australian Cotton CRC, Toowoomba**
Funding was provided in part by Cotton R&D Corporation and Grains R&D Corporation.

Photos:

Tethered helicoverpa larva and metal peg
Camera set-up in cotton field
Solar panels and recorder in a cotton field

Figures:
Figure 1. Nocturnal activity of predators in a corn field on the Downs. Data are presented as the time (mins) predators were present in the field of view during each 30 min period throughout the night.
Figure 2. Percentage of larvae eaten by different predator species in maize.

(These are all low quality images specifically for electronic transfer)



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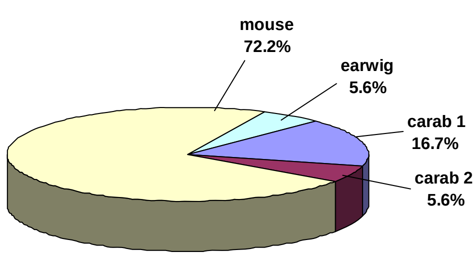

Figure 2. Percentage of larvae eaten by different predator species in maize.