Pacific damsel bug: Friend or foe?

By Mark Wade, Myron Zalucki and Bernie Franzmann

Determining the diet of insects present in cotton should be among the first steps in any applied research program. Omnivorous species are particularly important as they have the potential to suppress pest populations through prey feeding, but also to cause economic damage to the crop through plant feeding.

The apple dimpling bug (Camplyomma liebknechti) is a good example of a species with a mixed diet. The Pacific damsel bug (Nabis kinbergii) is normally considered a strict carnivore and important predator of cotton pests such as aphids and heliothis.

But there is recent circumstantial evidence that Pacific damsel bugs may also feed on squares and bolls. We caged Pacific damsel bugs on cotton branches in the glasshouse and watched individual bugs in the field and glasshouse to determine if plant feeding occurs.

Adult Pacific damsel bug feeding on a heliothis egg in the laboratory. Photo Anthony O'Toole.

What was done?

Feeding cage studies

We caged Pacific damsel bugs on cotton branches at squaring and boll filling growth stages for three days to determine the importance of plant and prey feeding.

The cages contained bugs or were bug free, with and without access to plant parts, and with and without access to prey.

We predicted that if bugs fed on cotton then treatments with access to plants would have improved survival and lowered prey consumption. Plant feeding may reduce the total number of fruit and increase the number of damaged fruit depending on whether damaged fruit are aborted or retained.

The presence of prey may reduce plant feeding, so plant feeding may increase in treatments with prey absent.

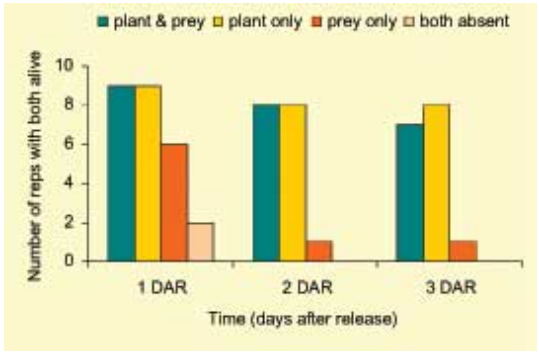

FIGURE 1: Bug survival: Boll feeding study

Observations on behaviour

We observed the feeding behaviour of Pacific damsel bugs in the field and glasshouse. In the field study we observed 330 nymph and adult Pacific damsel bugs in commercial cotton fields.

Observations on each bug lasted 10–15 minutes and were conducted during the day. We tallied the number of nymph and adult Pacific damsel bugs observed at least once in one of the following feeding activities:

• Plant tissue;

• Plant extrafloral nectar;

• Insect prey; or,

• Did not feed.

We combined the data for the nymph and adult life stages, as feeding activity was consistent between the stages. We predicted that Pacific damsel bugs would mainly feed on prey, followed by extrafloral nectar, and then plant tissue, if at all.

In the glasshouse we observed adult Pacific damsel bugs on potted cotton plants in 12 large cages. Plants were infested with heliothis eggs and larvae as prey.

Observations were conducted at hourly intervals night and day. We expected that bugs would feed more often during day than night sessions.

What was found?

Feeding cage studies

The survival of Pacific damsel bugs at all assessment dates in the square and boll feeding cage studies was significantly improved if bugs had access to cotton. The provision of prey improved bug survival at two and three days after release (DAR) in the square feeding study, but made no difference in the boll feeding study. Provision of prey appeared more important for survival of bugs without access to plants than for bugs with access to plants (Figure 1, boll feeding study only).

The presence of Pacific damsel bugs significantly increased mortality of heliothis eggs in the square and boll feeding studies. Male bugs consumed slightly more eggs per day than female bugs in the square feeding study, but this difference was not significant.

Prey (egg) mortality was not significantly affected by access to plants in the square and boll feeding studies.

The total number of fruit was not significantly influenced by the presence of bugs or prey in the square and boll feeding studies (Figure 2, boll feeding study only).

Observations on behaviour

Our observations of Pacific damsel bugs in the field and glasshouse showed that bugs readily fed on prey (eggs) and cotton extrafloral nectar, but not on intact plant tissue.

No bugs fed on plant tissue, 7.3 percent fed on extrafloral nectar, 3.0 percent fed on prey and the remaining 89.7 percent did not feed when observed. Individual bugs that fed did so on either extrafloral nectar or prey — never both — within the 15 minute observation period.

Bug feeding activity was significantly greater

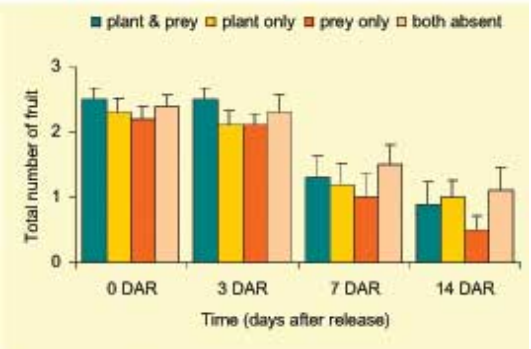

FIGURE 2: Effect on fruit: Boll feeding study

TABLE 1: Mean number of Pacific damsel bugs observed per cage in various feeding activities during day and night sessions in a glasshouse observation study

Feeding activity	Session time	
	Day	Night
Plant tissue	0.0	0.0
Plant extrafloral nectar	0.1	0.0
Prey	0.8	0.5
Did not feed	5.4	5.9
Total	**6.3**	**6.5**

during day than night sessions in the glasshouse study. No bugs fed on plant tissue during day or night sessions (Table 1).

What does this mean?

The results from the square and boll feeding cage studies do not clearly indicate whether bugs feed on intact plant tissue (see Figure 1). Improved survival of Pacific damsel bugs with access to plants suggests they gain essential moisture or nutrients from feeding on intact plant tissue and/or plant extrafloral nectar. This is not certain because bugs with access to plants may benefit from favourable microclimatic conditions.

Egg mortality was not affected by access to plants in the square and boll feeding studies.

The total number of fruit and number of damaged fruit were not affected by the presence of Pacific damsel bugs, which indicates that bugs did not feed on intact plant tissue, although it is conceivable that feeding occurred but did not cause damage symptoms (Figure 2).

Observations of feeding behaviour in the field and glasshouse provide the necessary detail to clarify the omnivory status of Pacific damsel bugs. The bugs mostly did not feed at all, although they readily fed on extrafloral nectar and prey, but never on intact plant tissue (Table 1).

So increased survival of Pacific damsel bugs with access to plants in the feeding cage studies is attributed to either extrafloral feeding and/or favourable microclimatic conditions, but not to plant tissue feeding. Our study leads us to dismiss the suggestion that Pacific damsel bugs are plant tissue feeders — but they do feed on extrafloral nectar.

Cotton extrafloral nectar is secreted from nectaries located on the largest midribs under the leaves and at the bases of bracts. This nectar is a recognised food source for many omnivorous arthropods, including predaceous bugs such as big-eyed bugs (Geocoris spp.) and pirate bugs (Orius spp.).

Extrafloral nectar contains various amino acids, sugars and water that are necessary for insect growth and development. It does not constitute a complete source of nutrition as some essential amino acids are missing. This may explain why access to extrafloral nectar increases survival but does not support development and reproduction in big-eyed bugs (Georcoris pallens), lady beetles (Coleomegilla maculata) and lacewings (Chrysoperla plorabunda).

Our feeding cage studies suggest that extrafloral nectar may sustain Pacific damsel bugs during brief periods of prey absence. When prey is more abundant, the importance of extrafloral nectar may be reduced.

Apart from the first day of the boll feeding study,

prey (egg) mortality was not influenced by access to plant food. So any feeding on extrafloral nectar does not interfere with prey consumption. This is important for biological control strategies.

Further studies on the effects of extrafloral nectar consumption on bug survival, development and reproduction, and the relative consumption of prey and plant resources as prey density changes are warranted to extend our understanding of plant feeding by Pacific damsel bugs.

This knowledge will be useful in the development of artificial food supplements and understanding the potential effects from plant feeding on transgenic pest resistant cotton cultivars.

Key points

Our studies have shown that Pacific damsel bugs feed on cotton extrafloral nectar, but not on intact plant tissue. This means that farmers and crop consultants should consider these bugs as a beneficial but not a pest species of cotton when making pest management decisions.

The results indicate that extrafloral nectar is important in the diet of Pacific damsel bugs. Consumption of extrafloral nectar may sustain bugs during brief periods of low prey availability, and should cause minimal disruption to prey feeding when prey are in high abundance.

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