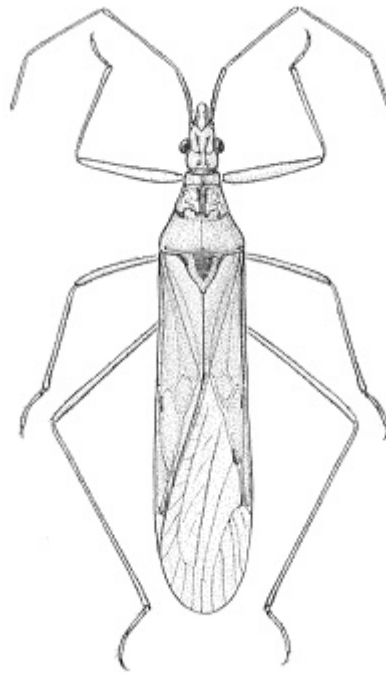


**BEHAVIOURAL ECOLOGY OF THE PACIFIC DAMSEL BUG, *NABIS KINBERGII*  
REUTER (HEMIPTERA: NABIDAE), IN COTTON FARMING SYSTEMS:  
TOWARDS 'REAL' IPM**

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Pacific damsel bug, *Nabis kinbergii*

Actual size approximately 8 mm in length

(used with permission from <http://www.ento.csiro.au/aicn/>)

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## ABSTRACT

The Pacific damsel bug, *Nabis kinbergii*, is a potentially important predator of key cotton pests. Aspects of Pacific damsel bug behavioural ecology, particularly feeding behaviour, were investigated to develop a better measure of rates of predation on cotton pests. Direct observation studies in the glasshouse showed that the frequency of observer presence had no influence on Pacific damsel bug distribution and activity or prey (heliopsis) mortality and distribution, during diurnal and nocturnal observation sessions. This represented the first documented test of observer presence in an insect species, and provided justification for future observational studies of Pacific damsel bug behaviour (Chapter 3). Pacific damsel bug behaviour did not vary significantly during diurnal periods in the field, but in the glasshouse feeding behaviour was greatest at dawn and during the morning. Further observations revealed that bugs fed at the same frequency during diurnal and nocturnal periods in the glasshouse. Knowledge of diel variation in Pacific damsel bug behaviour would be useful for predicting optimal times to observe, count, collect and manage these arthropods (Chapter 4).

Observation and inclusion cage studies in the glasshouse and field determined that Pacific damsel bugs fed on prey and cotton extrafloral nectar, but not on intact plant tissue. Pacific damsel bugs should be treated as an omnivore and beneficial, but not a pest species of cotton, and may respond positively to application of artificial food supplements to crops (Chapter 5). A single late-season application and nine season-long applications of the commercial artificial food supplement Amino-Feed UV in cotton had no effect on entomophagous and pest arthropod abundance, mortality rates of sentinel prey, fruit counts, crop yield and fibre quality. A critical review of the literature on artificial food supplements revealed that although the abundance of entomophagous arthropods increased in 34 out of 51 trials, and the abundance of pest arthropods declined in 14 out of 26 trials, increased profitability has not been demonstrated in the four trials where it was examined. The likelihood of a positive outcome in a trial was not significantly affected by annual or perennial cropping systems, single or multiple applications of the supplement, and carbohydrate and/or protein components of the supplement. This information would be useful for manufacturers, researchers and pest managers that seek to improve the efficacy of supplements (Chapter 6).

An assessment of the 'natural' diet of Pacific damsel bugs revealed seven new species of prey and that jassids comprised 44 % of prey items. Observation and inclusion cage studies in the glasshouse and field determined that Pacific damsel bugs each fed on  $0.69 \pm 0.19$  prey items per day. A review of the literature revealed that

Pacific damsel bugs each consumed an average of  $12.34 \pm 2.39$  prey items per day, however this may overestimate predation as 92 % of tests were conducted in the laboratory (field only estimate was  $0.58 \pm 0.19$ ). Data on Pacific damsel bugs feeding rates would be useful for researchers and pest managers that need to make predictions of pest mortality (Chapter 7). An investigation of predator-prey relationships in a season-long field trial found that the greatest densities of entomophagous and pest-other arthropods were achieved in the unsprayed control and chewing pests managed treatments. Despite this, the chewing plus sucking pests managed treatment had lowest plant damage and crop yield and highest profitability. Information on the abundance and impact of entomophagous and pest arthropods under various management regimes would be useful for making educated pest management decisions (Chapter 8).

An investigation of diel variation in beat sheet sampling estimates of arthropod density found that Pacific damsel bug density varied significantly over a day. Peak bug densities were detected at 07:00-08:00, 11:00-13:00 and 17:00-18:00 hours. The beat sheet method should be useful for sampling most arthropods in further studies of arthropod density (Chapter 9). Key findings were synthesised and recommendations for the direction of future research were outlined in the final chapter (Chapter 10).