BIOLOGY AND ECONOMIC DAMAGE OF SAP-SUCKING BUGS ON COTTON

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Introduction

The two major cotton pests Helicoverpa armigera Hübner and H. punctigera Wallengren have been subject to a great deal of biological and ecological research (Zalucki et al. 1986). In contrast, far less attention has been paid to cotton pests that are of secondary importance and that includes the sap-sucking bugs listed in Table 1 (Bishop 1980; Adams et al. 1984). The study reported here concentrated on these sap-sucking bugs, which were reputed to damage seedling and early-squaring cotton (e.g. Bishop 1980; Adams et al. 1984; SIRATAC 1983, 1984).

Table 1 The five species of sap-sucking bugs considered to damage early cotton in Australia.

Scientific name	Common name (Abbreviation)
Creontiades dilutus (Stål)	green mirid (GM)
Dereocoris signatus (Distant)	brown smudge bug (BSB)
Campylomma livida Reuter	apple dimpling bug (ADB)
Nysius clevelandensis Evans	grey cluster bug (GCB)
Nysius vinitor Bergroth	rutherglen bug (RB)

Aim of the project

The primary aim of this project was to establish economic injury levels (EIL) and economic thresholds (ET) for the sap-sucking bugs listed in Table 1. However, prior to the commencement of the EIL/ET study it was necessary to establish the specific pest status of these sap-sucking bugs. Contradictions in the interpretation of the pest status of BSB, ADB, GCB and RB were found in the literature. In particular, it was doubtful whether BSB and ADB were predatory or phytophagous; and whether GCB and RB were able to cause any significant damage to cotton (e.g. O' Brien 1978; Room 1979a,b; Bishop 1980; Adams and Pyke 1982; von Mengensen 1982; Adams et al. 1984; SIRATAC 1984,1985).

Clarification of the pest status of the sap-sucking bugs on cotton

Experiments were done to clarify the pest status of the bugs. Summary of the results are presented in Table 2.

Table 2 Results of the clarification pest status of the sap-sucking bugs (BSB, ADB, GCB and RB) on cotton.

Species	Status
BSB	Nymphs could not survive and develop to adulthood without prey (aphids). Adult survival was short (3.5 days) and they did not produce eggs when denied prey. Neither nymphs nor adults caused any significant damage to cotton. Conclusion: They are predatory.

ADB Nymphs required prey (Heliothis eggs) for survival and development to adulthood. Adults also needed prey for reproduction and survived for a significantly longer period when prey was available. Both nymphs and adults could cause significant damage to cotton tips and squares.
Conclusion: They are an obligatory predator and plant feeder.

GCB&RB Nymphs were unable to survive and develop to adulthood when provided with cotton only. Adult longevity was short and did not reproduce when provided with cotton. Nymphs and adults caused no significant damage to cotton.
Conclusion: GCB and RB are non-economic species on cotton.

BSB, GCB and RB were excluded from the EIL/ET study. Even though ADB could cause damage to cotton tips and squares, its pest status was clarified after the EIL/ET study had been done.

The only sap-sucking bug studied during the early stage of the project that proved to damage cotton was the green mirid (C. dilutus). However, prior to the commencement of the EIL/ET study, two mophorlogically similar species of Creontiades were found on various species of plants e.g. lucerne, Mayne's pest and cotton at the experimental site (Biloela). Specific identifications have not been finalised, so they are temporarily called "Creontiades sp. No. 1" and "Creontiades sp. No. 2". When individuals of C. sp. No. 1 were exposed to cotton, they caused more growing tips to wilt

than C. sp. No. 2, at least in the adult stage; and C. sp. No. 1 was more commonly found in cotton fields in Biloela than C. sp. no. 2. Therefore, C. sp. No. 1 was selected for the EIL/ET study.

EIL/ET study

The EIL/ET study on C. sp. No. 1 was performed on two stages of cotton (cv. Deltapine 90) (i) seedling (presquaring) and (ii) early-squaring (from the first till the fifth week of squaring). Insect densities of 0.5, 1, 2 and 4 per m^2 were used in the seedling experiment and insect densities of 1, 2, 4 and 8 per m^2 were used in the early-squaring experiment. The artificial infestations of the adults of C. sp. No. 1 were done in field cages, at the DPI Research Station, Biloela. Two main results were obtaied from the study.

(i) None of the insect densities used in either experiment caused a significant decrease in lint yield when compared with control treatments that were kept free of insects.

(ii) Insect densities of 4 per m^2 in the seedling and 4 and 8 per m^2 in the early-squaring experiment delayed harvest by about 7 days.

Conclusions and discussion

Two main conclusions can be drawn about management of sap-sucking bugs in cotton.

(i) It is evident that BSB is predatory, while GCB and RB are not economically important species on cotton,

therefore, in commercial practice they should not be considered as pests.

(ii) The insect densities applied in the EIL/ET study did not reduce lint yields; but they delayed boll maturity by about 6 to 7 days. It is possible that the densities of C. sp. No. 1 that can cause lint yield losses are higher than 4 per m^2 in the seedling stage and 8 per m^2 in the early-squaring stage. While it might be appropriate to use higher densities in future studies, it should be recognized that those used in this study were well above the currently used commercial thresholds. This could mean that commercial thresholds are too low or commercial sampling techniques provide very poor estimates of absolute numbers. In addition, it should be noted that this study was conducted in one of the hottest cotton growing areas and the results may not reflect the response of the plants in the cooler areas.

Mirid feeding has the potential for indirectly influencing the value of the crop by inducing delayed maturity. In order to prevent a delay cotton growers would have to consider controlling an infestation of 4 per m^2, or more in the seedling and early-squaring stages. On the other hand, since many cotton growers cannot harvest all their cotton in less than 6 to 7 days, they could ideally manage part of their crop for normal or early harvest (i.e. insecticides applied to control mirid infestations), and part for a delay (i.e. no insecticides applied for mirid control). The size of the area treated for mirids relative to the area

untreated would depend on the rate at which picking could proceed.

Future research for mirids

1. The green mirids (Creontiades species)
   (i) Species identification of Creontiades from cotton in southeastern Queensland and northern New South Wales.
   (ii) Improvements to sampling i.e. establish the relationship between the absolute number and the number found in commercial sampling.
   (iii) Compare damage symptoms on seedling and squaring cotton caused by mirids and by other insects e.g. tipworms, Heliothis spp.
   (iv) Host preference of mirids for oviposition, feeding and development- alternative host plants (e.g. lucerne, Mayne's pest) vs. cotton.
   (v) Quantitative and qualitative ranking the importance of the alternative host plants of mirids.
   (vi) Sampling number of mirids on alternative host plants (e.g. lucerne, Mayne's pest) as a potential early warning for cotton.
   (vii) The migration rate of mirids from alternative host plants to cotton.
   (viii) Effect of host plant resistance characters on the seasonal occurence of mirids on cotton crop.
   (ix) Test new cultivars before commercial release.
   (x) Test the effect of systemic insecticides.
   (xi) Conduct EIL/ET study in cooler areas.

2. The apple dimpling bug (ADB)

   (i) Develop improved culturing methods of ADB.

   (ii) Feeding biology of ADB on its usual host plants.

   (iii) Damage potential of ADB on seedling and squaring cotton.

3. The brown smudge bug (BSB)

   (i) Potential of BSB as a predator in cotton fields.

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