CAN BENEFICIAL INSECTS BE CONSERVED IN COTTON FIELDS?

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Introduction.

Australian cotton production relies heavily on insecticides for the control of the major pests, *Helicoverpa* spp., mites and sucking insects (Fitt 1994). An over-reliance on insecticides results in problems of insecticide resistance especially (*H. armigera*), disruption of natural enemies and environmental contamination have cast doubt on the long term viability of the traditional insecticidal approach. The major focus of the cotton industry is therefore to reduce the dependence on insecticides. This can be achieved by developing control programmes that minimise pesticide use through integration with other forms of control, especially predation by natural enemies of *Helicoverpa* spp. Despite widespread use of economic thresholds in the current production systems little emphasis has been placed on beneficial insects while the reliance on chemicals negates the use of the term integrated pest management (IPM) for such a system. A true IPM system should conserve beneficial insects and utilize them as basic components in the management of key pests. Beneficial insects for a long time have been neglected in most cotton IPM programmes due to a lack of techniques to maximise both their abundance and effectiveness (Mensah and Harris 1994). A logical question that arises is " Can beneficial insects be conserved in cotton fields "?. If the answer is yes; are there any technique/s available to achieve this ?

We have therefore conducted in field experiments for the past two years to develop a food product that can be used to attract, conserve and augment natural enemies especially predatory insects in cotton fields and utilized them as basic components of IPM programme to manage *Helicoverpa* spp and other pests on cotton. The results of these experiments are reported here.

Materials and Methods

The study was conducted in a commercial irrigated cotton field at Auscott in Narrabri, NSW. The various food supplements / sprays evaluated were (1) 3kg Envirofeast 1 (Dept. of Agriculture & Co., Orange, NSW) per hectare (2) 4 kg Sugar per hectare (3) 3kg Envirofeast 2

(Dept. of Agriculture & Co., Orange, NSW) per hectare (3) a mixture of 0.5% petroleum oil (Lovis) and 0.5% Kelgum (Kelco & Co., San Diego, CA) (4) control (untreated) and (5) plot treated with conventional insecticide (treated control). Plots were arranged in randomized complete block design with 4 replicates. Each replicate measured one hectare. A 400m buffer separated the conventional insecticide treated plot and rest of treatments to minimize insecticide drift. Similarly a 10 metre wide buffer separated food spray plots and untreated controls. Pre-treatment counts of beneficial insects were made 24h before treatment application and then every 7 days until the end of the study.

Foliar applications of each treatment were applied on November 4, 1992 and thereafter at 14 days intervals until the end of February, 1993 when spraying ceased. On each occasion 142l of each treatment was applied per hectare. In all eight applications of each treatment were made during the season. The control (untreated) plot was left unsprayed and the growers plot (treated control) received 8 applications of synthetic insecticides and *Bacillus thuringiensis* (Bt) by means of ground rig in early season and by aircraft mid and late season. Predatory insect were sampled from cotton plants in each treated plot between 7 am and 10 am on each sample date. They were sampled by taking 50 sweeps (one sweep/plant) of 180^{o} with a sweep net through the canopy of the cotton plant in each plot (from December 11, 1992 to January 21, 1993) and a 20 metre long vacuum sampling using a Dvac (from January 28, 1993 to March 4, 1993). After each sampling, the contents of the net or Dvac were transferred to a plastic bag, chilled, and taken to the laboratory, where they were frozen until identified and counted. Data was expressed as numbers per sampling date per sweep or metre for each treatment.

Results

Predatory insect groups collected in net- sweeping and Dvac samples included *Coccinella repanda* (transverse ladybird) *Harmonia arcuata* (three- banded ladybird), *Diomus notescens* (two - spotted ladybird), (Fig. 1); *Lauis bellulus* (red and blue beetle), *Geocoris lubra* (big-eyed bug), *Nabis capsiformis* (damsel bug) (Fig. 2); *Chrysopa* spp. (green lacewing) and spiders (*Lycosa* and *Oxyopes* spp. (Fig. 3). Other natural enemies like brown lacewings, glossy-shield bug, two toned caterpillar parasites, banded caterpillar parasites etc. were also occasionally recovered from the food sprayed plots and especially Envirofeast 1 plots but their numbers were too low to be analysed. Ladybird beetles identified in this study responded more

positively to applications of Envirofeast 1 than to any other treatments. Numbers of lady bird beetles (transverse, three - banded and two - spotted) increased significantly ($P<0.01$) throughout the study on plots sprayed with Envirofeast 1 (Fig. 1). This was followed by sugar, Envirofeast 2 and Oil plus Kelgum sprayed plots. The plots treated with conventional insecticides had the lowest number of ladybird beetles at each sampling date (Fig. 1). Red and blue beetles, big-eyed and damsel bugs also responded positively to the application of Envirofeast 1 (Fig. 2) Their numbers were significantly higher ($P<0.05$) in the Envirofeast 1 sprayed plot than all other treated plots with the conventional insecticide plots recording the least (Fig. 2). Other results summarized in Fig 3, indicated that green lacewing numbers were significantly greater ($P<0.05$) in the Envirofeast 1 treatment plot followed by Envirofeast 2, sugar, untreated control and Oil plus Kelgum plots respectively. Other predators found in all treated plots but not significantly increased by food spray were spiders (Fig. 3B). Spider numbers were similar in all food-spray and untreated control plots but significantly reduced in the insecticide treated plots (Fig. 3B). Numbers of ladybird beetles, red and blue beetles, big - eyed bugs, damsel bugs and green lacewings were virtually exterminated by the insecticide treatment (Fig. 1, 2 and 3).

Discussion

The results of this study indicates that naturally-occuring predatory beetles, bugs and lacewings, which are important predators of *Helicoverpa* spp., responded positively to the provision of supplementary food in the form of Envirofeast (food) spray. The study also indicated that beneficial insects can be conserved in cotton fields through the use of Envirofeast sprays. The food spray acted to attract and concentrate predators by supplementing their food in the absence of the prey. The method of spraying food supplements on commercial cotton may be useful tool in integrating beneficial insects into current pest management systems. With resistance of *Helicoverpa* spp. to insecticides increasing, and the possibility that insect resistance will be a major problem even with transgenic cotton, there is the need for the cotton industry to seriously consider the potential of IPM systems that place much more emphasis on the role of beneficial insects in the management of key pests in order to sustain future cotton production.

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Reference

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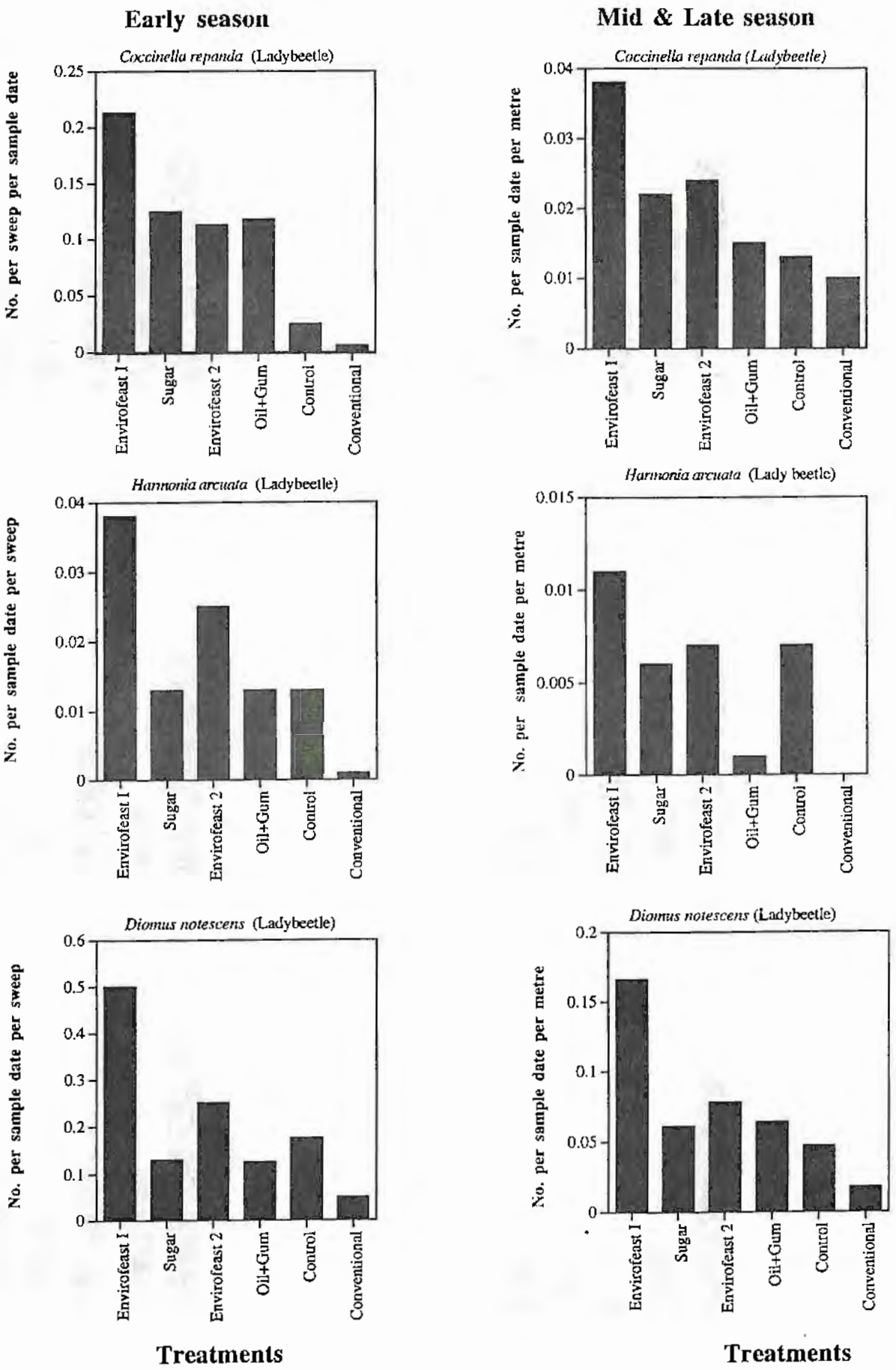

Fig. 1. Effect of provision of food supplements on numbers of coccinellids (ladybeetles) on commercial cotton at Auscott in Narrabri, 1992 - 93.

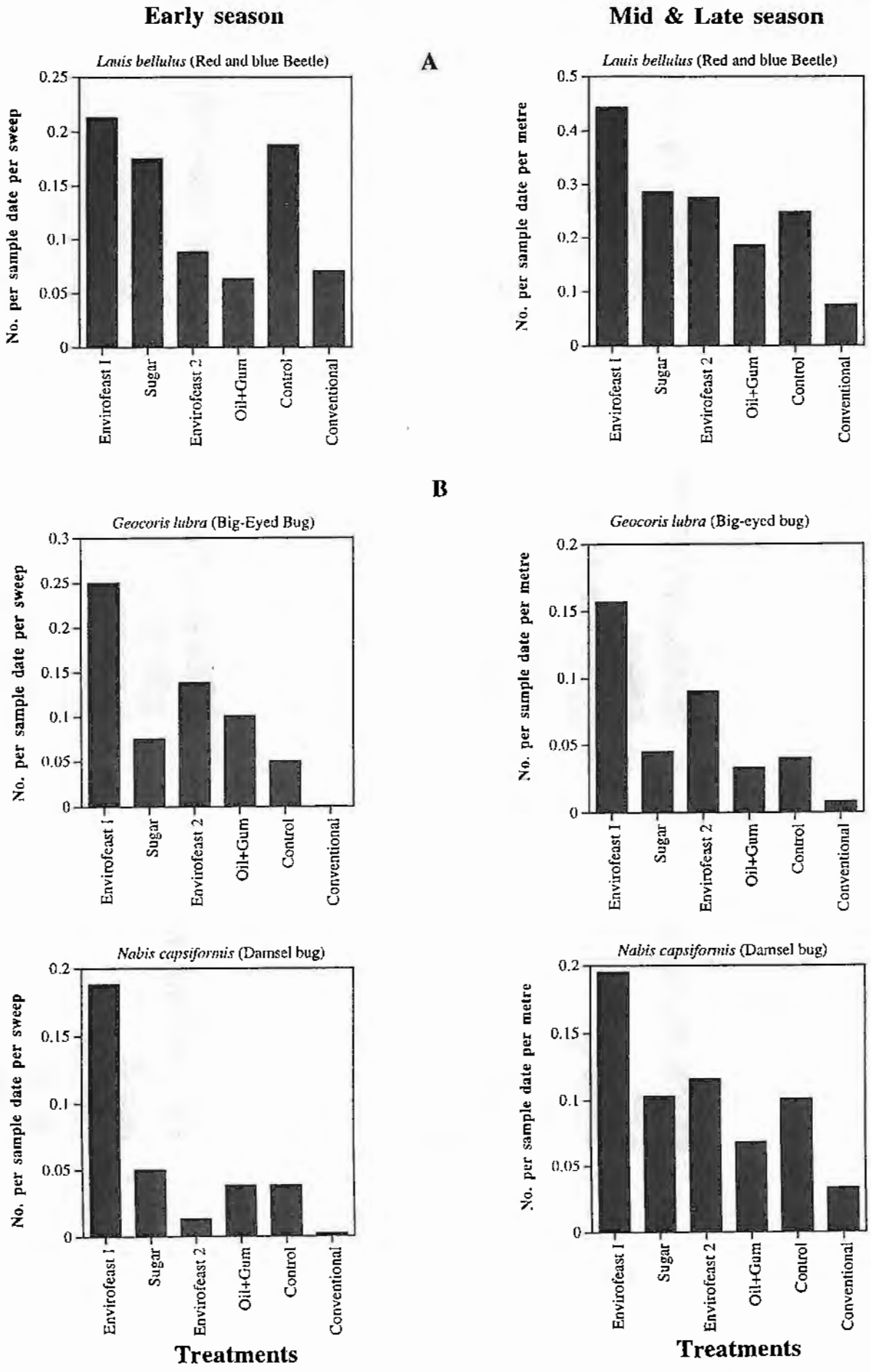

Fig 2. Response of (A) *Lauis bellulus* and (B) predatory bugs (*Geocoris lubra* and *Nabis capsiformis*) to food spray on commercial cotton, 1992-93.

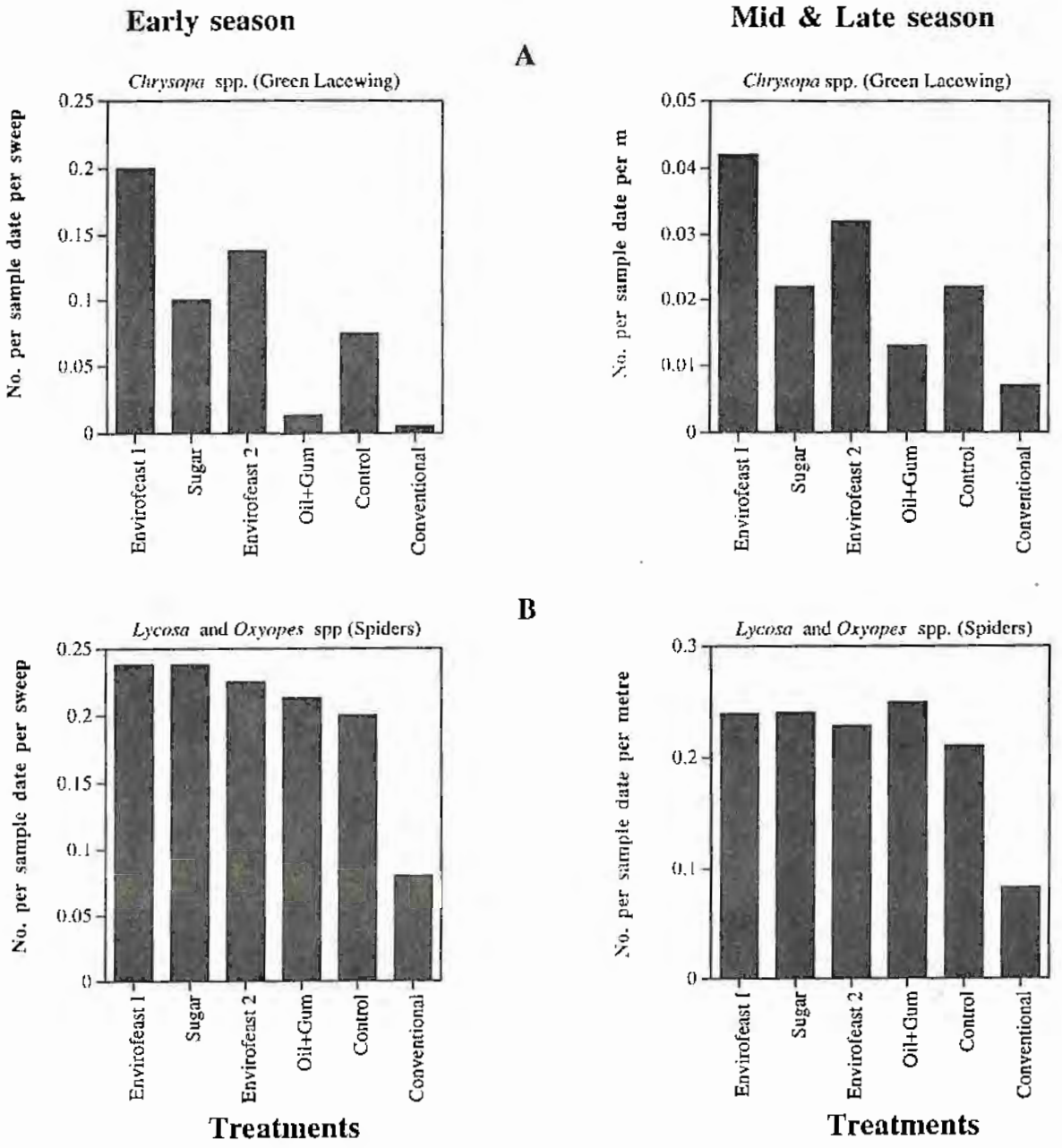

Fig. 3. Response of (A) *Chrysopa* spp. (Green lacewings) and (B) Spiders to food sprays on commercial cotton, 1992 - 93.