GROWTH OF *GEOCORIS PUNCTIPES* (HEMIPTERA: LYGAEIDAE) ON ATTACHED AND DETACHED LEAVES OF PEST-RESISTANT SOYBEANS

D. J. Rogers[1] and M. J. Sullivan[2]
Department of Entomology
Clemson University
Clemson, SC 29634-0365
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ABSTRACT

A field experiment using attached soybean, *Glycine max* (L.) Merrill, leaves showed that fresh weight gain of *Geocoris punctipes* (Say) (Hemiptera: Lygaeidae) nymphs between days 14 and 21 was greater on 'Govan' and 'Bragg' leaves than on leaves of PI229358. Weight gain on 'Govan' leaves was greater than on PI171451 leaves. In the same experiment, there were no differences in fresh weight growth of *G. punctipes* nymphs on detached leaves of the four genotypes.

Key Words: Soybean, *Geocoris punctipes,* plant resistance.

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INTRODUCTION

In natural habitats, big-eyed bugs (*Geocoris spp.*) feed on insect prey, green plant material, seeds, and dead insects (Crocker and Whitcomb 1980). The quality of the insect prey affects the nutritional importance of the green plant material. For some prey types (e.g., insect eggs), consumption of plant material provides only moisture (Dunbar and Bacon 1972; Cohen and Debolt 1983), while for other prey (e.g., aphids) plant material is essential for proper nymphal development (Dunbar and Bacon 1972; Tamaki and Weeks 1972). The effect of green plant food from 'Bragg' soybean and ten weed species on *G. punctipes* was studied by Naranjo and Stimac (1985). Using detached leaves, they found that all 11 plant species were equally suitable for *G. punctipes* development, survival and reproduction.

Evidence of translocatibility of the insect-resistance factor in PI229358 was provided by Lambert and Kilen (1984) when they showed antibiosis resistance to *Heliothis zea* (Boddie) (Lepidoptera: Noctuidae) was translocated across a graft between the plant introduction (PI) 229358 and susceptible cultivar 'Davis.' Jones and Sullivan (1979) reported that, compared to 'Bragg,' PI171451 and PI229358 reduced nymphal fresh weight gain and increased developmental time and mortality of *Nezara viridula* (L.) (Hemiptera: Pentatomidae). Because this species can only ingest liquid food, it is likely that the antibiosis-resistance effects were caused by properties of the plant juices. On the basis of those two studies, we hypothesized that *G. punctipes* growth might be adversely affected by feeding on insect-resistant soybeans.

[1] Present address: Entomology Branch, Department of Primary Industries, P.O. Box 23, Kingaroy, Queen, Australia 4610.
[2] Edisto Research and Education Center, P.O. Box 247, Blackville, SC 29817.

Using green beans as a basis for comparing soybean plant foods, Rogers and Sullivan (1986) reported increased mortality of 7- to 14-day-old *G. punctipes* nymphs on PI174151, decreased mortality on 'Govan,' and no difference on 'Bragg' and PI229358. We also found that the direct effects of plant food from the PIs were smaller than the indirect effect (i.e., those transmitted through the nymphs' insect food). One possible reason for those differences is that the use of detached leaves in experiments may lead to underestimation of the direct effects of the pest-resistant genotypes.

In this field study, we compared attached and detached leaves of pest-resistant and susceptible soybean genotypes as plant food for *G. punctipes* nymphs.

MATERIALS AND METHODS

The eight plant-food treatments in this experiment were detached and attached leaves of the 'Bragg,' 'Govan,' PI171451 and PI229358 soybean genotypes. Plants were grown in Clemson, SC, field plots with non-limiting moisture. Leaves of comparable age and condition from the upper one-third of the crop canopy were used in the field studies. The experiment was conducted as a 4 × 2 split-plot design which was replicated six times during the growing season with plants in growth stages between V10 and R6 (Fehr and Caviness 1977).

The study was conducted using 450-ml field cages of a type described by Bernhardt (1979, 52-3) and illustrated in Grant and Shepard (1985, Fig. 3D). This type of cage could enclose attached leaflets while maintaining unrestricted vascular contact with the remainder of the plant. Any gaps where the petiole of an attached leaflet emerged from the cage were plugged with a piece of cotton ball. Detached leaflets were positioned similarly in the cup cages, and were replaced on days 3 and 5 of the experiment. To maintain leaf turgor, petioles of detached leaflets were inserted through the caps of 4-ml plastic vials into water. For all treatments, 3 to 5-cm^2 from the basal section of a center trifoliolate leaflet was provided as the source of plant food for the *G. punctipes* nymphs. Each field cage contained one type of plant food, and a freshly killed velvetbean caterpillar (VBC), *Anticarsia gemmatalis* Hubner (Lepidoptera: Noctuidae).

VBC larvae were reared in the laboratory from eclosion to the final instar on pinto-bean diet modified from that of Greene et al. (1976) by the substitution of alfalfa meal for soybean protein. Larvae were killed by crushing their head capsules just before use. One freshly killed VBC larva was added to each cage at the initiation of the experiment (day 1), and on days 3 and 5.

Prior to their use in the experiment *G. punctipes* nymphs were maintained in a rearing chamber at 26.5 ± 1°C, 60 ± 10% RH, and a photoperiod of 14 hrs:10 hrs (L:D) from egg eclosion to day 14. During this period, nymphs were confined in 1400-ml cylindrical plastic containers with screened lids [approximately 100 first instar (nymphs/container) and were fed freshly killed VBC larvae, green bean (*Phaseolus vulgaris* (L.)] pods and sunflower (*Helianthus annus* L.) seeds. The bean pods and VBC larvae were replaced three times per week. The inside of the container was misted with distilled water at each feeding. On day 14, groups of 10 nymphs were weighed and confined in the field cages. When the nymphs were 21 days old, cages were returned to the laboratory, and surviving bugs were weighed and counted.

Weight gain data were analyzed by analysis of variance of the split plot design using PROC GLM of the SAS statistical package and hand calculation. The standard errors of difference for the comparisons at the sub-plot level (Table 1) were calculated using the formula given by Steel and Torrie (1980, 381) for a split-plot design.

Table 1. Fresh weight gain (mg/nymph) of 14- to 21-day-old *Geocoris punctipes* nymphs on attached and detached soybean leaves in the field.

Leaf	Soybean genotype*				
Treatment	'Govan'	'Bragg'	PI171451	PI229358	SE
Attached	1.26 a	1.20 ab	1.07 bc	0.99 c	± 0.052
Detached	1.07 a	1.06 a	1.10 a	0.97 a	± 0.052

* Means followed by different letters are significantly different within a row ($P < 0.05$, Fisher's LSD test).

RESULTS AND DISCUSSION

There were no significant differences in *G. punctipes* fresh weight gain among detached leaflets of the four soybean genotypes (Table 1). However, fresh weight gain of *G. punctipes* on the attached leaves of 'Govan' and 'Bragg' was significantly greater than on attached leaves of PI229358. In addition, weight gain on attached 'Govan' leaves was significantly greater than on attached PI171451 leaves.

The varietal rankings for *G. punctipes* weight gain on attached leaves in this study parallel (a) the rankings for VBC growth on the four genotypes and (b) the rankings of *G. punctipes* nymphal performance on plant-reared insect food, as presented in Rogers and Sullivan (1986). This pattern in the responses strongly suggests that weight gain on detached leaves does not accurately reflect the normal response of *G. punctipes* nymphal development from its soybean plant food. The study also shows that the response of *G. punctipes* to plant food from insect-resistant and susceptible soybean genotypes is similar to its response to insect-food reared on these same genotypes (Rogers and Sullivan 1986).

The study of plant suitability for *G. punctipes* development, survival and reproduction by Naranjo and Stimac (1985) needs to be reassessed in the light of this experiment, because of the use of detached leaves throughout their studies. The lack of difference between plant species reported by Naranjo and Stimac (1985) may be a consequence of using detached leaves rather than indicating a true lack of difference in suitability between plant food sources.

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