Big-Eyed Bugs (Hemiptera: Lygaeidae) and the Striped Lynx Spider (Araneae: Oxyopidae): Intra- and Interspecific Interference on Predation of First Instar Corn Earworm (Lepidoptera: Noctuidae)[1]

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ABSTRACT To understand agroecology and to increase the role of entomophages in pest management, it is important to understand interactions among arthropod predators. Laboratory studies were conducted with 1-2 adult big-eyed bugs, (BEB) *Geocoris* spp., 1-2 striped lynx spiders (SLS), *Oxyopes salticus* Hentz (1st-3rd instar), or one of each to investigate conspecific and interspecific interference of predation on 1st instar *Heliothis zea* Boddie in the laboratory. The number of 1st instar *H. zea* consumed per individual in 24 h fell significantly when two adult BEB were confined together compared with the number consumed by solitary BEB. Placing two juvenile SLS together did not reduce the number of larvae consumed per individual in 24 h. The combined feeding rate of one BEB and one SLS confined together fell well below the sum of the rates for solitary BEB and SLS, but it was unclear to what degree each predator's feeding rate was reduced. These results suggest that exceeding the optimum density of BEB and SLS in the field could reduce the biocontrol of *H. zea* provided by BEB.

KEY WORDS Insecta, big-eyed bugs, striped lynx spider, predation, interference, corn earworm.

The striped lynx spider (SLS), *Oxyopes salticus* Hentz, and big-eyed bugs (BEB), *Geocoris* spp., are two of the most common arthropod predators attacking *Heliothis* spp. in U.S. agricultural systems. Striped lynx spiders are the most frequently collected spider in many agricultural crops (Laster 1966, Baily and Chada 1968); BEB are one of the most consistent and abundant of all insect egg predators found in agricultural fields (Whitcomb and Bell 1964).

Intra- and interspecific encounters are inevitable among BEB and SLS. Both are primarily diurnal and actively range over the entire host plant searching for prey (Crocker and Whitcomb 1980, Brady 1964). Striped lynx spiders and BEB are generalist feeders and have been shown to prey on one another (Nyffeler et al. 1987, Guillebeau and All 1989). However, the behavior of predators and parasitoids may be altered by encounters with other arthropods even if no attack takes place.

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Intra- and interspecific interference occurs among many predaceous arthropods, including BEB and spiders. Irwin et al. (1974) reported that total consumption of pink bollworm, *Pectinophora gossypiella* Sanders, eggs increased with density of *Geocoris pallens* Stal and *Geocoris punctipes* Say, but consumption per predator decreased. Experimental releases of high densities of spiders have not augmented the predatory effect of the spiders (Kayashima 1961, Riechert 1981). Interactions between different species have variable effects; competition between two orb weavers reduced predation (Spiller 1986), and strong competitive interactions among a five species complex of parasitic hymenoptera maximized parasitism (Ismail and Long 1982).

These experiments were conducted to investigate intra- and interspecific interference of predation of 1st instar *Heliothis zea* Boddie occurring among BEB and SLS.

Materials and Methods

Big-eyed bugs and SLS were collected with a sweep net from alfalfa grown on the University of Georgia agronomy farm near Watkinsville, Ga. during the summer of 1987. *H. zea* eggs were obtained from a culture maintained at the ARS-USDA Coastal Plain Experiment Station in Tifton, Georgia.

Intra- and interspecific interference of predation upon *H. zea* larvae was investigated with unsexed adult BEB (primarily *Geocoris uliginosus* Say) adults and unsexed juvenile (2nd-3rd instar) SLS. In each experiment, 1-2 BEB, 1-2 SLS, or one of each was confined with more 1st instar *H. zea* larvae than they would consume in 24 h (8-15 larvae).

The subjects of each experiment were placed in 60 mm x 15 mm petri dishes with a small piece of paper towel moistened with distilled water. Petri dishes with prey but no predators served as controls. Predators were starved for 24 h immediately before each experiment to ensure a feeding response; different individuals were used in each experiment. The dishes and their contents were placed into temperature cabinets (27° C., photoperiod 12:12 L:D), and the results were recorded after 24 h. Each experiment was replicated 25 or more times.

Data were subjected to a student's t test to determine significant differences ($\alpha = 0.05$) in the number of *H. zea* larvae consumed by individual predators and various combinations of predators.

Results and Discussion

No mortality occurred among the controls in 24 h; dead prey items were assumed to have been killed by predators.

Adult BEB were most efficient when confined alone with *H. zea* larvae, consuming an average ($\pm$ S.D.) of 8.2 $\pm$ 2.7 1st instar larvae (n=30) in 24 h. Two adult BEB confined together were significantly less efficient ($t=9.4$; $P<0.05$), consuming 3.1 $\pm$ 1.3 larvae/BEB in 24 h (n=30).

Similar behavior has been reported among BEB feeding on eggs. In field cages, total consumption of pink bollworm eggs increased with greater densities of BEB, but consumption per predator was reduced (Irwin et al. 1974). On caged cotton plants, 16,134 *G. punctipes* per ha did not consume significantly greater numbers

of *Heliothis virescens* F. eggs than 5,378 geocorines/ha; maximum consumption of *H. virescens* eggs occurred with an intermediate density of BEB (Hutchinson and Pitre 1983).

Confining two juvenile SLS together did not reduce their individual consumption of *H. zea* larvae. Solitary spiders consumed an average of 4.1 ± 2.0 1st instar larvae in 24 h (n=25). The predation rate per individual did not change significantly ($t=0.09$; $P>0.05$) when two juveniles were confined together (4.2 ± 0.75 larvae/spider in 24 h, n=25), indicating that 2nd-3rd SLS do not mutually interfere with predation. Adult SLS could not be confined together or with BEB because of a tendency for the spiders to preferentially feed on the other predator over *Heliothis* spp. larvae; juvenile SLS can be placed together or with adult BEB with little risk of cross predation or cannabilism (Guillebeau and All 1989).

Conspecific intolerance exhibited by most adult spiders (Riechert and Lockley 1984) was not observed among the juvenile spiders used in these experiments. SLS are known to be tolerant of conspecifics in the first instar before they disperse from the egg site (Whitcomb and Eason 1967). Examples of age dependent interference are uncommon in arthropod literature; however, Sih (1981) observed that among populations of the predaceous waterbug, *Notonecta hoffmani* Hungerford, the presence of adults inhibits conspecifics from feeding on mosquito larvae while juveniles do not mutually interfere with predation.

Predation again was reduced when a BEB and SLS were confined together. In 30 replicates, a BEB and SLS together consumed an average of 6.8 ± 5.1 1st instar larvae per 24 h, which was significantly greater than the average feeding rate (4.1 ± 2.0) of solitary SLS ($t=2.46$; $P<0.05$). However, their combined rate falls well below the sum of the individual predation rates (12.4) of BEB (8.2) and SLS (4.1). The combined predation rate was not significantly greater ($t=1.4$; $P>0.05$) than the average feeding rate (8.2 ± 2.7) of solitary BEB. These data indicate that the feeding rate of one or both predators was reduced when they were confined together. Additionally, there was a trend for solitary BEB to consume more *H. zea* larvae per 24 h than the BEB/SLS combination, providing evidence that BEB were inhibited from feeding by the presence of the spider. Inhibition of spider feeding by the presence of the BEB was neither confirmed nor denied by these data.

Interspecific interference of predation has been reported among parasitoids and predators. Some parasitic wasps avoid the trails of other species of female parasitoids as well as conspecifics (Price 1970). Vinson and Guillot (1972) reported that increased parasitoid density leads to a greater proportion of time spent avoiding other parasitoids ultimately reducing the number of hosts attacked. Interactions with other species reduced the rate of *N. hoffmani* feeding on mosquito larvae (Sih 1981).

In summary, the results suggest tht exeeding the optimum density of BEB and SLS in the field could reduce the efficiency of BEB controlling pest populations. Adult BEB were inhibited from feeding on 1st instar *H. zea* by the presence of another adult BEB, but mutual interference was not observed among SLS juveniles. When an adult BEB and a juvenile spider were confined together, predation rates were reduced, but it was not clear to what degree each predator was inhibited.

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References Cited

Baily, C. L. and H. L. Chada. 1968. Spider populations in grain sorghum. Ann. Entomol. Soc. Am. 61: 567-571.

Brady, A. R. 1964. The lynx spiders of North America north of Mexico, Bull. Mus. Comp. Zool. 131: 429-518.

Crocker, R. L. and W. H. Whitcomb. 1980. Feeding niches of the big-eyed bugs *Geocoris bullatus* and *G. punctipes.* Environ. Entomol. 9: 508-513.

Guillebeau, L. P. and J. N. All. 1989. Big-eyed bugs and the striped lynx spider: cross predation and prey preferences. J. Econ. Entomol. 82: 1106-1110.

Hutchinson, W. A. and H. N. Pitre. 1983. Predation of *Heliothis virescens* eggs by *Geocoris punctipes* adults in cotton. Environ. Entomol. 12: 1652-1656.

Irwin, M. E., R. W. Gill, and D. Gonzalez. 1974. Field cage studies of native egg predators of the pink bollworm in southern California cotton. J. Econ. Entomol. 67: 193-196.

Ismail, A. B. and G. E. Long. 1982. Interactions among parasites of the larch casebearer in northern Idaho. Environ. Entomol. 11: 1242-1247.

Kayashima, S. 1961. Study of the lynx spider, *Oxyopes sertatus,* for the biological control of the cryptomerian leaf fly. Rev. Appl. Entomol. 51: 413.

Laster, M. L. 1966. Predator populations in cotton in the delta area of Mississippi. Ph.D. Thesis. Miss. State Univ.

Nyffeler, M., D. A. Dean, and W. L. Sterling. 1987. Evaluation of the importance of the striped lynx spider, *Oxyopes salticus,* as a predator in Texas cotton. Environ. Enomol. 16: 1114-1123.

Price, P. 1970. Characteristics permitting coexistence among parasitoids of a sawfly in Quebec. Ecology. 51: 445-454.

Riechert, S. E. 1981. The consequences of being territorial: spiders, a case study. Am. Nat. 117: 871-892.

Richert, S. E. and T. Lockley. 1984. Spiders as biological control agents. Ann. Rev. Entomol. 29: 299-320.

Sih, A. 1981. Prey density and age dependent interference in an aquatic insect predator, *Notonecta hoffmani.* J. Anim. Ecol. 50: 625-632.

Spiller, D. A. 1986. Interspecific competition between spiders and its relevance to biological control by general predators. Environ. Entomol. 15: 177-181.

Vinson, S. T. and E. B. Guillot. 1972. Host marking: source of a substance resulting in host discrimination in insect parasitoids. Entomophaga. 17: 241-245.

Whitcomb, W. H. and K. Bell. 1964. Predaceous insects, spiders, and mites of Arkansas cotton fields. Ark. Agr. Exp. Sta. Bull. 690: 1-84.

Whitcomb, W. H. and R. Eason. 1967. Life history and predatory importance of the striped lynx spider. Ark. Acad. Sci. Proc. 21: 55-58.