DEVELOPMENTAL STAGES OF *SPISSISTILUS FESTINUS* (HOMOPTERA: MEMBRACIDAE) MOST SUSCEPTIBLE TO HEMIPTERAN PREDATORS

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ABSTRACT

The developmental stages of *Spissistilus festinus* most susceptible to predation by young female adults of *Geocoris punctipes* and *Nabis roseipennis* and to *Orius insidiosus* of undetermined age and sex was determined in the laboratory. With *G. punctipes*, the highest *S. festinus* mortality (90-100%) occurred in the early (1st, 2nd) nymphal stages while *Nabis roseipennis* attacked all nymphal stages equally well. In general, *O. insidiosus* did not feed on *S. festinus*. This study suggests that *S. festinus* nymphs are potential prey for *G. punctipes* and *N. roseipennis* in the field.

Key Words: *Geocoris punctipes, Nabis roseipennis,* biological control.

RESUMEN

En pruebas de laboratorio fueron determinados los estados de desarrolo de *Spissistilus festinus* más susceptibles a la depredación por hembras adultas de *Geocoris punctipes* y *Nabis roseipennis* así como por *Orius insidiosus* de edad y sexo indeterminados. Con *G. punctipes*, la mortalidad de *S. festinus* más alta (90-100%) ocurrió en los estados ninfales tempranos (1° y 2°) mientras *N. roseipennis* atacó todos los estados ninfales de la misma manera. En general, *O. insidiosus* no se alimentó de *S. festinus*. Este estudio sugiere que las ninfas de *S. festinus* son presa potencial de *G. punctipes* y *N. roseipennis* en el campo.

The threecornered alfalfa hopper, *Spissistilus festinus* (Say), is considered a pest of economic importance in soybean, *Glycine max* (L.), and other legume crops in several southeastern states. Researchers in Arkansas (Mueller & Dumas 1975) and Louisiana (Sparks & Newson 1984, Sparks & Boethel 1987) report yield losses resulting from feeding by adults and nymphs of this pest. The main damage is caused when the base of the main stem is girdled resulting in dead or weakened plants.

The importance of entomophagous arthropods in preventing the increase of lepidopterous pest populations in field crops, including soybean, has long been recognized (Lopez et al. 1976, Lawrence & Watson 1979, Richman et al. 1980). A parasitoid (Jordan 1952, Herting & Simmonds 1972) and several predators (Spurgeon 1992) of *S. festinus* have been reported. Polyphagous predators such as *Geocoris spp.*, *Nabis spp*., and *Orius insidiosus* (Say), which are frequently abundant in many soybean-growing areas of the United States (Roach 1980, Barry 1973, Bell & Whitcomb 1963), may suppress *S. festinus* populations in soybeans. However, the impact of predators on this insect pest has not been evaluated.

A laboratory study was designed to determine the developmental stages of *S. festinus* most susceptible to predation by adults of *Geocoris punctipes* (Say), *Nabis roseipennis* Reuter, and *O. insidiosus*.

Materials And Methods

Spissistilus festinus were obtained from a laboratory colony maintained on *Phaseolus vulgaris* L. pods at 26° ± 1 C, 70 to 80% RH, and a photoperiod of 14:10 (L:D). The colony was revitalized periodically with field-collected adults to overcome adverse selection effects of laboratory rearing.

Nymphs of *G. punctipes* and *N. roseipennis* were collected with sweep nets in alfalfa, *Medicago sativa* L., fields in southwestern Arkansas during the spring-summer of 1992. They were fed in the laboratory until the adult stage on second instar soybean looper, *Pseudoplusia includens* (Walker). Green bean pods were also provided. *Orius insidiosus* adults of undetermined age and sex were collected from an alfalfa field at the University of Arkansas experimental farm at Fayetteville. Before the experiment, *O. insidiosus* were fed *Helicoverpa zea* (Boddie) eggs and green bean pods. The three to five-week-old female *G. punctipes* and *N. roseipennis* and adult *O. insidiosus* were starved for 24h before the experiment.

Potted V2 soybean plants (CV:Bragg) were covered by cages and placed in an environmental chamber at 25° ± 1 C, 60% RH and a photoperiod of 14:10 (L:D). Cages were made by cutting off both ends of two-liter clear plastic soda bottles and gluing a screen cloth at the top end to allow air movement. The soil at the base of the plants was covered with a brown-paper disc to facilitate finding dead insects. The base of the cage in contact with the soil was sealed by placing tape around the bottom of the cage and the upper rim of the pot.

A completely randomized design with 10 replications was used. Treatments were three predator species (*G. punctipes, N. roseipennis,* and *O. insidiosus*) and six *S. festinus* developmental stages (nymphal instars 1-5 and adult). *Spissistilus festinus* eggs were not tested. One starved adult predator was placed with one *S. festinus* of a single developmental stage (1 predator vs. 1 prey) on a potted soybean plant. Cages containing only plant and prey with no predator served as controls. Mortality was recorded after 24 h. Any dead *S. festinus* were assumed to have been killed by the predator. Mortality of *S. festinus* was not adjusted for the control because of low (<5%) mortality in controls. Values of proportion dead were analyzed using a Chi-square test. Means were compared by a two-sample binomial test (Ott 1984).

Results and Discussion

Significant differences in percentage mortality among the *S. festinus* developmental stages between *G. punctipes* and *N. roseipennis* were observed (Chi-square=9.52, df=4, P<0.05). *Orius insidiosus* fed minimally (10% mortality) on the first nymphal stage and did not feed on larger nymphal or adult *S. festinus* stages. Values for *O. insidiosus* were not included in the Chi-square test because of the low frequency of mortality (<1) observed for all prey developmental stages. These results suggest that *Orius insidiosus* is probably not an important predator of *S. festinus* in nature. The highest *S. festinus* mortality (100%) was observed when first instars were exposed to *G. punctipes* (Table 1). This mortality was not significantly different (P=0.05, two-sample binomial test) from the mortality (90%) obtained when second and third nymphal stages were exposed to *G. punctipes* and N. *roseipennis* predators, respectively. *Nabis roseipennis* attacked all nymphal stages equally well (P=0.05, two-sam-

TABLE 1. PERCENT MORTALITY OF NYMPHAL STAGES OF *SPISSISTILUS FESTINUS* DUE TO PREDATORS.

	Prey Developmental Stage					
Predator	N1	N2	N3	N4	N5	Adult
Geocoris	100 a[1]	90 ab	60 b	10 cd	0 d	0 d
Nabis	60 b	60 b	90 ab	50 bc	50 bc	10 cd
Orius[2]	10	0	0	0	0	0

[1]Values followed by the same letter do not differ at the 0.05 probability level using a two-sample binomial test for equal proportions. Comparisons were carried out between *Geocoris* and *Nabis* predators and prey stages within predator species indicated.

[2]Values for *Orius* were not included in the Chi-square test because of the low frequency of mortality (<1) observed.

ple binomial test). *Nabis roseipennis* was the only predator that fed on adult *S. festinus* (10% killed).

Geocoris punctipes caused the highest mortality of nymphal instars (first through third), which are probably the most susceptible to attack (Table 1). Crocker & Whitcomb (1980) found that the largest percentage (79%) of target prey captured under natural conditions by *Geocoris spp*. are those that remain passive during physical contact with the predator. Early and intermediate nymphal stages are probably not able to adequately defend themselves and their strategy of remaining motionless for certain periods of time is not an effective behavior for avoiding predation. The lower predation on fourth and fifth instars by *G. punctipes* can be attributed to the more active physical movements of the prey during predator-prey encounters and to their more well-developed spines. Further biological studies on prey-predator interactions under laboratory and field conditions will provide basic information for developing predictive models on population dynamics of pests and natural enemies that can be used in pest management programs. These studies indicate that because *G. punctipes* and *N. roseipennis* fed on *S. festinus* nymphs in the laboratory they are potential predators for this pest in nature.

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