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# Feeding Responses of *Euthyrhinchus floridanus* (Heteroptera: Pentatomidae) to *Megacopta cribraria* (Heteroptera: Plataspidae) with *Spodoptera frugiperda* and *Anticarsia gemmatalis* (Lepidoptera: Noctuidae) Larvae as Alternative Prey[1]

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*Euthyrhynchus floridanus* (L.), known by the common name Florida predatory stink bug (Heteroptera: Pentatomidae), is a colorful native predator that is very common through the year in many different agro-ecosystems. It feeds on a diversity of crop pests including immature Lepidoptera and Coleoptera (Logan et al. 1987, Entomophaga 32: 249–254; Medal and Santa Cruz 2014, Florida Entomol. 97: 830–834) and also a variety of plant-damaging pentatomoids (Mead 1976, Florida Department of Agriculture and Consumer Services–Division of Plant Industry Entomol. Circ. 174: 1–2; Richman and Whitcomb 1978, Florida Entomol. 61: 113–119), including kudzu bug *Megacopta cribraria* (F.) (Heteroptera: Plataspidae) nymphs and adults. Its range includes most of the southeastern and central United States, Mexico, and Central and South America into southern Brazil (Ables 1975, J. Georgia Entomol. Soc. 10: 353–356; Oetting and Yonke 1975, Ann. Entomol. Soc. Am. 68: 659–662; Buschman and Whitcomb 1980, Florida Entomol. 63: 154–162; Thomas 1992, The Thomas Say Foundation Vol. XVI, Entomol. Soc. Am.; Hagen et al. 1999; Mead and Richman 2013, http://entnemdept.ufl.edu/creatures/beneficial/e_floridanus.html). *Euthyrhynchus floridanus* has a reddish-orange spot at each side of the scutellum and one spot in the middle of the black-blue body. The male is smaller than the female. Length of the male is 1.1 to 1.2 cm with a humeral width of 0.5 to 0.6 cm. Female length is 1.4 to 1.6 cm with a humeral width of 0.7 to 0.8 cm. Females lay irregular egg masses of 13 to 83 ($n = 60$) dark-colored eggs of approximate 1-mm individual egg size that hatch in 2 to 3 weeks (Oetting and Yonke 1975, Ann. Entomol. Soc. Am. 68: 659–662; Richman and Whitcomb 1978). Nymphs have a black-bluish head and a pronotum with a red abdomen and a black

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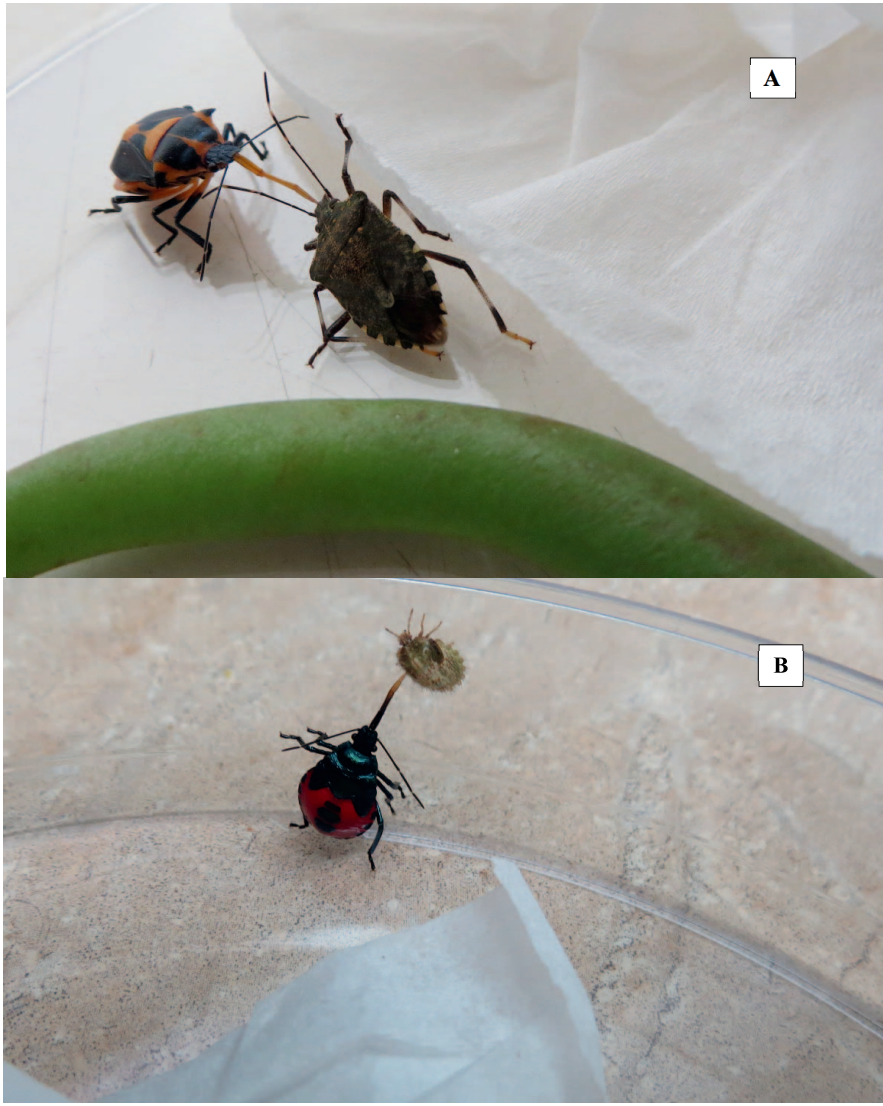


**Fig. 1. *Euthyrhynchus floridanus* female feeding on a brown marmorated stink bug, *Halyomorpha halys* (Stål) (Heteroptera: Pentatomidae) female (A). *Euthyrhynchus floridanus* fourth instar feeding on a kudzu bug fifth instar (B).**

mark in the center of the body. Nymphs and adults tend to be aggregated and have a low level of cannibalism. Both nymphs and adults capture prey of different sizes and feed individually (Fig.1) or in aggregations. Females begin laying eggs approximately 2 weeks after becoming adults (Ables 1975). In this laboratory study,

we determined the feeding response of *E. floridanus* to kudzu bugs and alternative lepidopteran prey in controlled environmental conditions.

*Euthyrhynchus floridanus* used in this study was obtained from a laboratory colony established from nymphs and adults collected in a kudzu *Pueraria montana* Lour. (Merr.) variety *lobata* (Willd.) (Fabales: Fabaceae) patch in Gainesville, Alachua County, FL (29°38′22.87″N, 82°23′56.76″W) during the summer and fall of 2012. *Megacopta cribraria* third and fourth instars were collected in the same kudzu patch in Florida. The *M. cribraria* adults utilized in the experiments were obtained from nymphs collected on kudzu plants and held in the laboratory in clear plastic containers (23 cm width × 32 cm length × 10 cm height) with moistened paper and field-collected kudzu leaves/vines. Growing conditions were set at 25° ± 3°C, 16:8-h (light:dark) photoperiod, and 50–60% relative humidity. Fall armyworm larvae, *Spodoptera frugiperda* (J. E. Smith) were obtained from the USDA–Agricultural Research Service laboratory colony located in Gainesville, FL., and velvetbean caterpillar larvae, *Anticarsia gemmatalis* (Hübner), were field-collected on wild legume plants.

*Euthyrhynchus floridanus* nymphs (third and fourth instars) and male/female adults were starved for 24 h before the experiment. Individual nymphs and adults were placed in petri dishes (14.6 cm × 2.5 cm) with a bean pod, moistened paper, and crumpled Kimwipes® (Kimberly-Clark, Roswell, GA) to provide hiding places for the predators. One intermediate *M. cribraria* nymphal stage or an adult was provided to one nymphal-stage third or fourth instar *E. floridanus* or a male or female adult predator and an additional 1-week-old *S. frugiperda* and /or *A. gemmatalis* as alternative preys. These larval lepidopteran preys were chosen because they are commonly found on kudzu plants when *M. cribraria* immatures and adults were present. A complete randomized design with 20 replications was used. Experiments with *E. floridanus* and alternative preys began on 25 September 2012. Prey mortality was recorded after 24 h. Percentage of prey mortality data for each predator stage were subject to an analysis of variance (SAS Institute 2002). Means were separated using a least significant difference (LSD) procedure when appropriate.

These studies indicated that the feeding responses of *E. floridanus* male, female, and intermediate nymphal stages to kudzu bug as a major prey were not affected by the presence of *S. frugiperda* and/or *A. gemmatalis* larvae, and all the predator stages showed, in general, a preference to feed on *M. cribraria* (Table 1). The *E. floridanus* females and intermediate nymphs were more effective than males, showing higher prey mortality of *M. cribraria*. *Megacopta cribraria* nymph mortality by *E. floridanus* females or intermediate-size nymphs was not significantly different when no alternative prey was present (Table 1). Mortality of *M. cribraria* when an alternative prey was available ranged from 70 to 100% for *E. floridanus* females and from 50 to 100% for *E. floridanus* intermediate-size nymphs. In general, feeding on *A. gemmatalis* by *E. floridanus* adults or immature stages was lower than on *S. frugiperda*. A possible explanation for the lower feeding response may be related to the defense mechanism of *A. gemmatalis* larvae when attacked. When disturbed by a predator, *A. gemmatalis* swung its anterior or posterior end or made quick lateral body movements to repel the predator. The percentage of mortality of *M. cribraria* adults or nymphs due to *E. floridanus* male, female, or intermediate-stage nymphs differed significantly ($P < 0.05$, LSD). The *E. floridanus* female in general, was a

**Table 1. Mortality (% ± SD) of kudzu bug, *Megacopta cribraria,* caused by *Euthyrhynchus floridanus* nymph in the presence of alternative prey (fall armyworm, *Spodoptera frugiperda*, and/or velvetbean caterpillar, *Anticarsia gemmatalis*).**

| | Treatment with Nymph Predator | | | |
|---|---|---|---|---|
| Prey | Kudzu bug | Kudzu bug + fall armyworm | Kudzu bug + velvetbean caterpillar | Kudzu bug + fall armyworm + velvetbean caterpillar |
| Kudzu bug nymph | 90 ± 7 | 100 ± 0 | 80 ± 10 | 80 ± 11 |
| Fall armyworm larva | | 100 ± 0 | | 80 ± 8 |
| Velvetbean caterpillar | | | 20 ± 7 | 20 ± 6 |
| Kudzu bug male | 60 ± 9 | 100 ± 0 | 90 ± 7 | 80 ± 7 |
| Fall armyworm larva | | 80 ± 11 | | 80 ± 6 |
| Velvetbean caterpillar | | | 10 ± 6 | 10 ± 6 |
| Kudzu bug female | 40 ± 8 | 60 ± 7 | 70 ± 6 | 50 ± 7 |
| Fall armyworm larva | | 40 ± 8 | | 50 ± 8 |
| Velvetbean caterpillar | | | 0 ± 0 | 20 ± 7 |
| | Treatment with Female Predator | | | |
| Prey | Kudzu bug | Kudzu bug + fall armyworm | Kudzu bug + velvetbean caterpillar | Kudzu bug + fall armyworm + velvetbean caterpillar |
| Kudzu bug nymph | 100 ± 0 | 80 ± 10 | 90 ± 7 | 100 ± 0 |
| Fall armyworm larva | | 60 ± 11 | | 70 ± 7 |
| Velvetbean caterpillar | | | 30 ± 8 | 20 ± 6 |
| Kudzu bug male | 90 ± 8 | 70 ± 9 | 80 ± 10 | 90 ± 6 |
| Fall armyworm larva | | 50 ± 9 | | 60 ± 7 |
| Velvetbean caterpillar | | | 30 ± 9 | 0 ± 0 |
| Kudzu bug female | 70 ± 9 | 90 ± 6 | 80 ± 10 | 70 ± 8 |
| Fall armyworm larva | | 50 ± 8 | | 60 ± 10 |
| Velvetbean caterpillar | | | 10 ± 5 | 0 ± 0 |

**Table 1. Continued.**

| | Treatment with Male Predator | | | |
|---|---|---|---|---|
| Prey | Kudzu bug | Kudzu bug + fall armyworm | Kudzu bug + velvetbean caterpillar | Kudzu bug + fall armyworm + velvetbean caterpillar |
| Kudzu bug nymph | 70 ± 11 | 60 ± 12 | 70 ± 11 | 80 ± 8 |
| Fall armyworm larva | | 50 ± 11 | | 50 ± 11 |
| Velvetbean caterpillar | | | 0 ± 0 | 0 ± 0 |
| Kudzu bug male | 60 ± 12 | 70 ± 12 | 60 ± 13 | 70 ± 9 |
| Fall armyworm larva | | 50 ± 12 | | 40 ± 11 |
| Velvetbean caterpillar | | | 10 ± 6 | 10 ± 6 |
| Kudzu bug female | 30 ± 7 | 60 ± 9 | 60 ± 7 | 50 ± 11 |
| Fall armyworm larva | | 40 ± 11 | | 40 ± 12 |
| Velvetbean caterpillar | | | 20 ± 7 | 0 ± 0 |

more effective predator of the kudzu bug females when compared to male or intermediate nymphal stage *E. floridanus*, and the feeding response was not affected by the presence of a caterpillar as alternative prey. Results indicated that *E. floridanus* is an effective generalist predator of the kudzu bug that may contribute significantly to reducing the kudzu bug population in infested regions.

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