NOTE

Foliage Consumption and Larval Development of Three Noctuid Pests on Soybean and Cotton[1]

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The beet armyworm, *Spodoptera exigua* (Hübner), has a wide host range that includes vegetables, ornamentals, and field crops (Metcalf and Metcalf, 1992, Destructive and Useful Insects, 5th ed., McGraw-Hill, New York). This insect is an occasional pest of soybean in portions of the southern United States. Beet armyworm can be difficult to control with insecticides on cotton, and consequently, it has been a greater threat in recent years with heavy populations occurring on cotton in Louisiana (Burris et al., 1994, Fl. Entomologist, 77: 454-459), Mississippi (Layton, 1994, Proc. Beltwide Cotton Conf., pp. 854-856), Alabama, and Georgia (Smith, 1994, Proc. Beltwide Cotton Conf., pp. 13-14).

When beet armyworm occurred on soybean in northern Louisiana in 1993, questions arose concerning the status of this noctuid as a pest of soybean and the population densities required to cause yield loss. Some controversy exists in the literature concerning the damage potential of beet armyworm on soybean, and this appears to be based on whether pod feeding occurs. Economic losses resulting from pod feeding have been reported in Mississippi (Tillman et al., 1995, J. Entomol. Sci., 30: In press) and Arkansas (McLeod et al., 1978, J. Ga. Entomol. Soc., 13: 266-269). However, the beet armyworm infestations we observed on soybean in northern Louisiana during 1993 and 1994 exhibited little pod feeding. Also, pod damage and yield reductions were not observed in field experiments involving beet armyworm on soybean conducted over a three-year period in Arkansas (Huffman and Mueller, 1983, J. Entomol. Soc., 76: 744-747). Action thresholds and control measures are recommended for soybean in Louisiana for other noctuid species (soybean looper, *Pseudoplusia includens*

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(Walker); velvetbean caterpillar, *Anticarsia gemmatalis* Hübner; and green cloverworm, *Plathypena scabra* (F.)) that often reach densities that cause economic losses (Baldwin et al., 1995, Control Soybean Insects 1995, Louisiana Cooperative Extension Service pub. no. 2211). However, Louisiana Cooperative Extension Service recommendations are not available for beet armyworm on soybean. Therefore, laboratory feeding bioassays were initiated to define the defoliation potential of beet armyworm relative to other noctuid pest species.

Soybeans (cv. 'Centennial') and cotton (cv. 'Delta Pine 50') were planted on 22 October 1993 in plastic pots (25-cm diam) containing field soil (Convent silty clay loam, fine-silty, mixed, nonacid, thermic Aeric Fluvaquent). Plants received supplemental lighting (1000 watt metal halide lamps ≈1 meter above terminals) and were fertilized every 3 wks following germination with ≈400 ml of a solution (3.5 ml dry product/liter of water) of 15-30-15 (N-P-K) (Sterns Miracle-Gro Products, Port Washington, NY). Soybeans also received ≈3 mg of peat-based inoculum per pot (*Bradyrhizobium japonicum* (Kirchner) Buchanan, Nitragin brand 'S' culture, LiphaTech, Inc., Milwaukee, WI). Fully-expanded leaves were collected from the upper 1/3 of plants beginning 50 (soybean) or 80 (cotton) days after planting and placed in feeding chambers (100 × 15 mm plastic Petri dish containing moistened filter paper). One neonate larva was placed in each feeding chamber that was maintained in a growth chamber (≈27°C, 50% relative humidity, 16:8 h light:dark photoperiod). Fifty feeding chambers were prepared for each species/host plant combination. Foliage consumption (leaf area consumed) and larval development time (days) of three noctuid species (beet armyworm, soybean looper, and velvetbean caterpillar) were evaluated on soybean foliage. In a separate experiment, two species (beet armyworm and soybean looper) also were evaluated on cotton foliage. All larvae used in these studies were acquired from the USDA-ARS Southern Insect Management Laboratory in Stoneville, MS.

When larvae were fed soybean foliage, significant increases in foliage consumption ranked by species occurred in the following order-soybean looper > velvetbean caterpillar > beet armyworm (Table 1). Beet armyworm required slightly longer to develop to pupation when fed soybean foliage compared to the other two species. Soybean looper consumed greater amounts of foliage than beet armyworm throughout larval development when fed cotton foliage; however, differences in larval development time were not significant (Table 1). Because separate experiments were conducted to evaluate soybean and cotton, foliage consumption and development time for each insect species were not compared statistically between hosts. However, in general, soybean looper and beet armyworm consumed less foliage and required approximately four more days to develop when fed cotton as opposed to soybean foliage.

In recent years when beet armyworm appeared on soybean in Louisiana, peak infestations occurred in densities that were similar to or lower than those of soybean looper (Wier et al., 1994, Arthropod Management Tests, 19: 274-275). Beet armyworm also developed simultaneously or later in the season than soybean looper. We also have observed that soybeans were in seed development stages (R5-R6) when beet armyworm infestations peaked; therefore; these infestations did not threaten blooms and small pods. Based on foliage consumption by individual larvae, the feeding bioassays indicate that beet armyworm presents less of a threat as a defoliating pest of soybean than soybean looper or velvetbean caterpillar.

Table 1. Consumption and development time for larvae of three noctuid species fed soybean or cotton foliage.

Species	Consumption (cm^2)		Development Time (days)
Soybean looper	103.8 a	– Soybean –	11.5 b
Velvetbean caterpillar	84.8 b		11.4 b
Beet armyworm	62.5 c		12.1 a
Soybean looper	86.0 a	– Cotton –	16.3 a
Beet armyworm	55.6 b		16.3 a

$P > F$ ANOVA < 0.01 (except ns for development time on cotton).

Column means for each host followed by similar letters are not significantly different ($P < 0.05$, LSD).

Therefore, greater densities of beet armyworm may be required on soybean before significant yield losses occur compared to these other noctuids if injury is restricted to defoliation. Even though beet armyworm may be considered a more serious pest of cotton than soybean looper because beet armyworm damages both foliage and fruit, soybean looper appears to consume greater amounts of cotton foliage than beet armyworm. General comparisons of larval development time on cotton versus soybean hosts indicate that cotton may be less suitable as a host for beet armyworm and soybean looper than soybean because these species required longer to develop to the pupal stage when fed cotton.

Other reports in the literature confirm that beet armyworm consumes less soybean foliage than other noctuid species. Boldt et al. (1975, J. Econ. Entomol., 68: 480-482) examined consumption of 'Clark 63' soybean by larvae of several noctuid species and reported that soybean looper and velvetbean caterpillar consume 2.2-fold or 1.6-fold more foliage, respectively, than beet armyworm (average consumption in cm^2 - soybean looper- 114, velvetbean caterpillar- 84, beet armyworm- 52). However, their research did not address the defoliation potential of beet armyworm on cotton, which is a relevant issue considering the severity of beet armyworm damage on cotton in recent years in the southeastern U.S. where soybean/cotton agroecosystems overlap.

In conclusion, the soybean looper and velvetbean caterpillar are the most serious defoliating pests of soybean in the southern United States, and each of these noctuid species consumed more foliage than beet armyworm in feeding bioassays. While pod feeding and economically-damaging populations of beet armyworm have been found on soybean in other southern states, smaller populations that primarily consumed foliage have been observed in Louisiana in recent years. Unless greater populations of beet armyworm develop or their feeding habits change, beet armyworm alone does not appear to be a serious defoliating pest of soybean in Louisiana. However, this species should be monitored as part of the complex of lepidopteran defoliators when sampling insect pests of soybean.