

Velvetbean Caterpillar, *Anticarsia gemmatalis* (Hübner) (Insecta: Lepidoptera: Noctuidae)¹

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Introduction

The velvetbean caterpillar, *Anticarsia gemmatalis* (Hübner) is the major pest of soybean in Florida and the southeastern states. Infestations of the caterpillar occur in the late summer months and can cause great damage to soybean and other legume crops if not managed. The caterpillar is able to strip fields of soybean foliage in five to seven days (Wilkerson *et al.* 1986). Management of the velvetbean caterpillar can be achieved through use of natural enemies, insecticides and various cultural practices.

Distribution

The velvetbean caterpillar is native to the tropical and subtropical areas of the Western Hemisphere and was first found in Florida in 1903 (Hinds and Osterberger 1931). The velvetbean caterpillar is a permanent inhabitant of tropical America and migrates northward into the southeastern United States every year. The caterpillar overwinters in the southern tip of Florida and moves north during the summer months. *A. gemmatalis* is an annual problem in the months of June through

September in Florida, Georgia and Alabama. Infestations of velvetbean caterpillar are less severe in the western United States.

Life Cycle and Description

Velvetbean caterpillars are active and will spring from plants and wiggle rapidly when disturbed. Individuals less than one-half inch long "loop" when they crawl and are often misidentified as soybean loopers (Sprenkel 1999). The life cycle of the velvetbean caterpillar is completed in about four weeks during the summer, but takes longer in the fall. The number of generations occurring depends on the dispersal and arrival of adults. Velvetbean caterpillar moths overwinter in southern Florida and begin moving northward in early summer. They arrive in north Florida by mid-August and are very abundant by September.

Egg

The eggs of the caterpillar are white, slightly oval and range from 1 mm to 2 mm in diameter and flattened on its lower surface. The egg is ribbed prominently and white until just before it hatches, when it turns pink. Eggs are laid singly on the under

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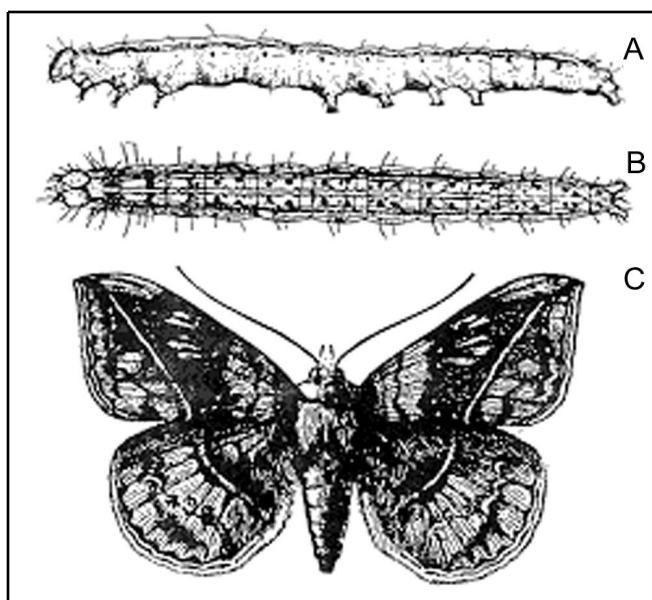


Figure 1. Velvetbean caterpillar, A-B Larvae, C Adult.
Credits: North Carolina State University
(http://ipmwww.ncsu.edu/AG271/soybeans/velvetbean_caterpillar.html)

side of leaves, although in heavy infestations eggs may be found on the upper surfaces of leaves, on the petioles and even on the stems (Watson 1916). The egg stage usually lasts about three days when laid in August and September but requires a week or more when laid later in the fall.

Larva

Newly hatched larvae feed on the shell of the egg from which they have just emerged leaving only the portion attached to the leaf. There are usually six instars in the larval stage of the velvetbean caterpillar. The larvae are extremely variable in coloration and markings throughout the instars. The majority of the caterpillars have prominent dark longitudinal lines and narrow lines of white, yellow or pink. The larvae spend about two days in the first instar and grow from 2.5 mm to 6 or 7 mm before molting. The head is light brown, rounded and bilobed. The body of the first instar velvetbean caterpillar is a uniform light green without any longitudinal stripes. The prolegs on the abdominal segments 3 and 4 are smaller than those on segments 5 and 6. In the second instar the black border to the lateral line appears and the first pair of abdominal prolegs are about one-fourth as long as the third pair. The second pair of prolegs are one-half as long as the third. The second instar lasts three to four days and

grows to a length of 9 mm. The third instar also lasts three to four days and the caterpillar can grow up to 16 mm in length. The fourth and fifth instars last three to four days and can grow up to 25 mm in length. During the sixth instar the velvetbean caterpillar becomes gradually lengthened and can grow up to 48 mm. The sixth instar lasts from five to 25 days. In the prepupal stage the larvae shrink to a length of 25 mm and turn mahogany brown with few if any longitudinal lines (Watson 1916).



Figure 2. Larvae of the velvetbean caterpillar, *Anticarsia gemmatalis* (Hubner), exhibiting green and brownish-black color phases. Credits: J. L. Capinera, University of Florida

Pupa

The pupa of the velvetbean caterpillar is light green until it is about a day old, when it turns brown in color. The pupa is smooth and averages 18 to 20 mm in length and 4 to 6 mm in width. It lies directly underneath the soil surface at a depth of about 2 cm in loose, frail earthen cells. Lee and Johnson (1990) found that pupae are found on and below the soil but never on the plant. The majority (84.5%) of the pupae was found less than 2 cm under the soil surface. The pupal stage usually lasts about seven days in late summer, and eleven days in early fall as weather becomes cooler the pupal stage is extended.

Adult

The adult moth is variable in patterning and coloration with a wingspan of 30 to 38 mm. The forewings of the velvetbean caterpillar moth vary from ash gray, light yellowish-brown, or dark reddish brown. The hind wings are light brown with a row of light colored spots near the margin. A dark diagonal

line extends across both sets of wings when the wings are fully extended.

As is characteristic of noctuids, the velvetbean caterpillar adult needs supplemental food after it becomes an adult (Wei *et al.* 1998). The primary food sources for adult Lepidoptera are flower nectars, and nectar availability has often been correlated with outbreaks of some lepidopteran pests (Jensen *et al.* 1974). Adult velvetbean caterpillars feed at night with peak feeding from sundown until dusk.

Host Plants

Soybean (*Glycine max*) is the primary host of the velvetbean caterpillar but it will feed on many other species including peanut, kudzu, velvetbean, horse beans, cotton, cowpea, coffeeweed, black locust, hairy indigo, lespedeza, sesbania, and white sweetclover (Waters and Barfield 1989). Legumes are the preferred host plant of the velvetbean caterpillar.

Damage

Velvetbean caterpillar larvae cause damage by consuming foliage. Newly hatched larvae strip the leaf beginning with the lower epidermis and mesophyll and continue until the end of the second instar when the caterpillar begins to skeletonize the leaf, eating all the soft material and leaving only the veins intact (Watson 1916). After the second instar the velvetbean caterpillar consumes the entire leaf. Once the upper leaves and lower leaves have been consumed, foliage in the middle and lower canopy is consumed and complete defoliation may result (Roberts and Guillebeau 1999). The velvetbean caterpillar may also attack tender stems, buds, and small bean pods.

Natural Enemies

Several species of parasitoids affect the velvetbean caterpillar. The most predominant parasitoid of the velvetbean caterpillar is *Winthemia rufopicta* (Bigot) (Diptera: Tachinidae). Among the wasp parasitoids, *Euplectrus puttleri* Gordh (Hymenoptera: Eulophidae) and *Meteorus autographae* Muesebeck (Hymenoptera: Braconidae) have been observed parasitizing the velvetbean

caterpillar (Daigle *et al.* 1990). Predominant parasitoids may vary from year to year and from location to location.

Predators of the velvetbean caterpillar are generalist predators that feed on other caterpillars. Among the observed predators of the velvetbean caterpillar are the ground beetles, *Calosoma sayi* Dejean, *Calleida decora* (Fabricius) and *Poecilus chalcites* (Say) (all Coleoptera: Carabidae); the tiger beetles *Megacephala carolina* (Linnaeus) and *Megacephala virginica* (Linnaeus) (both Coleoptera: Cicindelidae); the striped earwig, *Labidura riparia* (Pallas) (Dermaptera: Labiduridae) and the red imported fire ant, *Solenopsis invicta* Buren (Hymenoptera: Formicidae). Vertebrate predators such as birds, frogs, and rodents also act as natural enemies to the velvetbean caterpillar. Predation has been observed to be a significant factor in management of the velvetbean caterpillar. Lee *et al.* (1990) observed that predation was the principal mortality factor of the velvetbean caterpillar, accounting for 52.5 to 95.2% of mortality in field plots.

Several pathogens, mainly fungi, have been associated with the velvetbean caterpillar. The most important pathogens are the fungi *Nomurea rileyi* and *Entomophthora* sp. These pathogens contribute significantly to the natural control of the velvetbean caterpillar.

Management

Sampling

Direct observation of velvetbean caterpillars on the plant during the early stages of growth in the spring is the best sampling option due to the plants small size. As the plant grows a sweep net can be used to sample larval populations. A net is swept through the plant canopy a given number of times and then the insects are counted. Adult moth populations can be sampled using blacklight and pheromone traps. Pheromone traps should be placed at canopy height and are good indicators of a velvetbean caterpillar moth presence. Once moths are detected, searching for eggs and larvae is the next step.

Insecticides

The velvetbean caterpillar is the most important foliage-feeding pest of soybean in Florida. Insecticides are commonly used in the southeastern states to prevent velvetbean caterpillar damage. Studies indicate that the velvetbean caterpillar is more susceptible to insecticides when they are applied to insect resistant strains of soybean plants (Rose *et al.* 1988, Rowan *et al.* 1991). Resistant plants alone, however, do not serve to significantly reduce velvetbean feeding on soybean (Beach and Todd 1988). A preventative treatment of insecticide provides the most promising results in controlling velvetbean caterpillar.

Insect Management Guide for Soybean

Cultural Techniques

The most effective cultural practice employed in the southeastern states is that of early planting and/or early maturing varieties of soybean plants. Early planting allows soybean plants to mature before the velvetbean caterpillar populations become high. McPherson and Bondari (1991) found that late season velvetbean caterpillars in Georgia were more abundant in soybeans planted in early June than those planted in early May. The use of trap crops (more preferred crops that attract the pest) planted near soybean is also effective in the southeastern states. Early-planted soybeans often serve as a trap crop for the adults. Tillage seems to have no significant effect on increasing or decreasing velvetbean caterpillar populations (Funderburk *et al.* 1990).

Host Plant Resistance

Partial resistance to the pest is present in some soybean varieties, but is inadequate for complete protection. Resistant soybean plants do not decrease velvetbean caterpillar consumption. The only effect is that of slowed consumption, weight gain and growth rates in the early stadia (Beach and Todd 1988).

Biological Control

Several pathogens have been shown to reduce the abundance of velvetbean caterpillar. Richter and Fuxa (1984) found that velvetbean caterpillars were susceptible to a nuclear polyhedrosis virus (NPV) and

the bacterium *Bacillus thuringiensis* (Bt). The most effective parasitoid of the velvetbean caterpillar is the tachinid fly *Winthemia rufopicta* (Bigot).

Selected References

- Beach, R.M. and J.W. Todd. 1988. Foliage consumption and developmental parameters of the soybean looper and the velvetbean caterpillar (Lepidoptera:Noctuidae) reared on susceptible and resistant soybean genotypes. *Journal of Economic Entomology* 81: 310-316.
- Capinera, J.L. 2001. *Handbook of Vegetable Pests*. Academic Press, San Diego. 729 pp.
- Daigle, C.J., D.J. Boethel, and J.R. Fuxa. 1990. Parasitoids and pathogens of soybean looper and velvetbean caterpillar (Lepidoptera: Noctuidae) in soybeans in Louisiana. *Environmental Entomology* 19: 746-752.
- Douglas, W.A. 1930. The velvetbean caterpillar as a pest of soy beans in southern Louisiana and Texas. *Journal of Economic Entomology* 23: 684-690.
- Fuller, B.W. 1988. Predation by *Calleida decora* (Coleoptera: Carabidae) on velvetbean caterpillar (Lepidoptera: Noctuidae) in soybean. *Journal of Economic Entomology* 81: 127-129.
- Funderburk, J.E., D.L. Wright, and I.D. Teare. 1990. Preplant tillage effects on population dynamics of soybean insect pests. *Crop Science* 30: 686-690.
- Godfrey, K.E., W.H. Whitcomb and J.L. Stimac. 1989. Arthropod predators of velvetbean caterpillar, *Anticarsia gemmatalis* Huebner (Lepidoptera: Noctuidae), eggs and larvae. *Environmental Entomology* 18: 118-123.
- Hinds, W.E. 1930. The occurrence of *Anticarsia gemmatalis* as a soybean pest in Louisiana in 1929. *Journal of Economic Entomology* 23: 711-714.
- Hinds, W.E. and B.A. Osterberger. 1931. The soybean caterpillar in Louisiana. *Journal of Economic Entomology* 24: 1168-1173.

Jensen, R. L., L.D. Newsom, and J. Gibbens. 1974. The soybean looper: effects of adult nutrition on oviposition, mating frequency, and longevity. *Journal of Economic Entomology* 67: 467-470.

Lee, J.H. and S.J. Johnson. 1990. Microhabitat distribution of velvetbean caterpillar (Lepidoptera: Noctuidae) pupae in soybean fields in Louisiana. *Environmental Entomology* 19: 740-745.

Lee, J.H., S.J. Johnson and V.L. Wright. 1990. Quantitative survivorship analysis of the velvetbean caterpillar (Lepidoptera: Noctuidae) pupae in soybean fields in Louisiana. *Environmental Entomology* 19: 978-986.

McPherson, R.M. and K. Bondari. 1991. Influence of planting date and row width on abundance of velvetbean caterpillars (Lepidoptera:Noctuidae) and southern green stink bugs (Heteroptera:Pentatomidae) in soybean. *Journal of Economic Entomology* 84: 311-316.

Richter, A.R. and J.R. Fuxa. 1984. Pathogen-pathogen and pathogen-insecticide interactions in velvetbean caterpillar (Lepidoptera:Noctuidae). *Journal of Economic Entomology* 77: 1559-1564.

Roberts, P. and P. Guillebeau. (1999). Velvetbean caterpillar- *Anticarsia gemmatalis* (Huebner). Georgia IPM- integrated pest management. <http://www.gaipm.org/top50/velvetbean.html> (12 July 2000).

Rose, R.L., T.C. Sparks, and M. Smith. 1988. Insecticide toxicity to the soybean looper and the velvetbean caterpillar (Lepidoptera: Noctuidae) as influenced by feeding on resistant soybean (PI 227687) leaves and coumestrol. *Journal of Economic Entomology* 81: 1288-1294.

Rowan, G.B., H.R. Boerma, J.N. All, and J. Todd. 1991. Soybean cultivar resistance to defoliating insects. *Crop Science* 31: 678-682.

Sprenkel, R. (1999). Insect management in soybeans. Florida Cooperative Extension Service, University of Florida. ENY-405. <http://edis.ifas.ufl.edu/IG064> (12 July 2000).

Waters, D.J. and C.S. Barfield. 1989. Larval development and consumption by *Anticarsia gemmatalis* (Lepidoptera: Noctuidae) fed various legume species. *Environmental Entomology* 18: 1006-1010.

Watson, J.R. 1916. Life history of the velvetbean caterpillar (*Anticarsia gemmatalis* Huebner). *Journal of Economic Entomology* 9: 521-528.

Wei, X., S.J. Johnson, and A.M. Hammond. 1998. Sugar feeding strategy of adult velvetbean caterpillar (Lepidoptera: Noctuidae). *Environmental Entomology* 27: 1235-1241.

Wilkerson, G.G., J.W. Mishoe, J.L. Stimac. 1986. Modeling velvetbean caterpillar (Lepidoptera: Noctuidae) populations in soybean. *Environmental Entomology* 15: 809-816.