Dectes Stem Borer: A Summertime Pest of Soybeans

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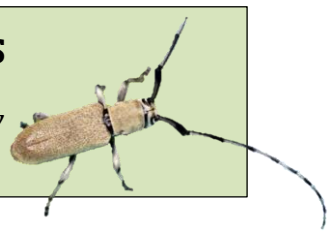

Introduction

The *Dectes* stem borer (*Dectes texanus* LeConte), aka soybean stem borer, is a native North American beetle that has been described as a sporadic pest of sunflowers and soybeans. It was first reported as a pest of soybeans in North Carolina in 1969. *Dectes* causes yield reductions by tunneling in and girdling stems prior to harvest. The girdling causes soybean plants to break and lodge, making it difficult to retrieve beans with harvesting equipment. Further, there can be physiological yield losses due to reductions in seed weight caused by tunneling. Despite their potential to reduce yield, overall yield loss associated with *Dectes* is not well documented. Strategies to control this insect should begin with correct identification and field scouting to determine if fields are infested.

Pest Identification

Adults. An adult stem borer is approximately 3/8 inch long with a slightly flattened body and a pair of long slender antennae that are of similar length or longer than the length of their body. The beetle is dark brown to black with short pale gray pubescence that give it an ash gray appearance. Their legs and antennae consist of black and gray bands (**Fig. 1**). Females are generally larger than males, especially their abdomen, but have shorter antennae. In addition, females may be distinguished from males by the shape of the last abdominal segment. This segment is elongated and pointed in females and more shortened and rounded in males.

Fig. 1. Adult *Dectes* stem borer

***Larvae/Pupae*.** Stem borers consist of six larval stages, or instars. The 1st larva stage is light yellow. The head capsule is light brown and contains a set of slightly darker mandibles. Mature larvae are creamy white or yellowish, and slender with "accordion-like" bodies and reddish-orange heads. Larval size may vary but they are nearly 1/2 inch long (**Fig. 2**). Pupae are yellowish and similar in shape and form as adults.

Fig. 2. Mature stem borer larva

Eggs. Stem borer eggs are laid in a hollow cavity within the leaf petiole or tender stem of soybean plants. Oviposition preference experiments indicate that they oviposit their eggs near the top of the growing plant. Splitting the petiole at the site of oviposition will reveal a small, oval shaped egg that is slightly tapered at each end. The egg is yellowish-white when initially deposited into the petiole but turns dark yellow near hatching (**Fig. 3**). Though several eggs may be laid in a single plant, larvae are cannibalistic and attack and

kill each other on contact, resulting in only one living larva per stem.

Life Cycle

Soybean stem borers are univoltine, which means they produce one generation per year. The first three instars feed and tunnel into the petiole pith until they are large enough to tunnel into the main stem. Older larvae then feed within the main stem until harvest maturity is reached and the plant dries out (senescent). The larva then tunnels to the base of the plant and cuts a transverse incision or "girdle" inside the stalk base or root crown. This act of girdling contributes to plants falling to the ground (lodging). The larva then hollows out the lower portion of the stem and packs the tunnel with frass (waste excrement), creating an overwintering chamber (**Fig 4)**. This frass plug protects the larva by sealing in the end of the hollowed out stem. Stem borer larvae then go into diapause and overwinter as mature larvae within the plant base.

Fig. 3. Egg inside leaf petiole

Following diapause in late spring, larvae enter their pupa stage, and begin to emerge as adults 8-10 days later. Adult emergence in Maryland typically begins in late-June and lasts over several weeks. Adults are subsequently present in soybeans fields until mid-August. Under laboratory conditions, adults fed for 2 days before mating was observed. This suggests that feeding is a prerequisite for mating. Newly mated 8-day-old females were able to oviposit eggs as soon as 4 days after mating. However, 7 to 8 days was the normal requirement. Females lay a single egg inside petioles or soft stems of soybean plants.

Fig. 4. Exposed section of soybean stem showing tunnel area with an overwintering stem borer larva.

Injury Symptoms

Adult stem borers feed in the upper portion of the canopy on tender stems, leaves and leaf petioles. Adults are light feeders, and feeding damage largely goes unnoticed. In plants where adults have laid an egg in the petiole, the petiole will wilt and eventually fall off, leaving behind a small reddish scar around the entrance hole. Plants can be visually inspected for oviposition scars early in the season and lodged plants in late summer. Dead leaves in the upper soybean canopy are the first obvious signs that larvae are present. Further feeding by larvae causes petioles to turn yellow, wilt and drop off near the area of the entrance hole. However, yellow petioles and entrance holes are not usually noticeable, and infestations are more reliably detected by splitting stems and searching for larvae.

Sampling and Thresholds

Adult stem borers are generally sampled with sweep nets in soybeans, but there is no reliable information on how to use these counts to make management decisions. More importantly, at this time, it is not possible to relate adult numbers to levels of larval infestation. A study conducted in Kansas showed that

total adult counts per 100 sweeps averaged 12 and 16 individuals, but the percentage of plants infested at the end of the season averaged 57 and 64%, respectively. It has been suggested that fields with greater than 50% of plants infested the prior year will likely be heavily infested next year; and that soybean fields planted in the vicinity of heavily infested fields the following year should be considered to be at high risk for heavy infestations.

Management Options

Management options for stem borers are limited and have not advanced much over the years. However, similar to other soybean pests, management options include chemical, biological, and cultural control tactics. The effectiveness of the available control options varies, and generally cultural control methods are recommended for mitigating losses.

- ***Insecticides.*** Though stem borers are susceptible to chemical sprays, insecticides are often not considered viable or economically feasible management options for suppressing larvae and/or adults. An early study showed that adult beetles can be easily controlled in cages by insecticides tested, but under natural field conditions these insecticides were not nearly as effective. Presumably, insecticidal sprays could not penetrate hollowed stubbles or frass plugs. This would deem sprays ineffective against active or overwintering larvae. Adult management with insecticides is also unlikely. Adults emerge from stubbles and subsequently females oviposit their eggs into soybean plants over an extended period of time. Some have reported their spring emergence to last 4 to 5 weeks. This would necessitate multiple applications and precise knowledge of when adults are emerging so that well-timed insecticide sprays can be administered. Despite the failure of early insecticide trials, it was recently demonstrated that two applications of an effective insecticide applied to large plots or whole fields could reduce infestations up to 80%. However, in those situations where sprays reduce levels of infestation, one must consider whether it results in a profit increase considering the application cost.

- ***Weed hosts.*** Wild host plants from the Asteraceae plant family such as sunflower, common and giant ragweed, and cocklebur are native wild hosts of *Dectes* stem borer. Crested anoda and cowpea have also been reported as suitable host plants. As such, these plants can be used as alternate hosts and additional egg-laying sites, and it is therefore recommended that these plants be managed.

- ***Crop Rotation.*** Adult stem borers are not known to undergo long distant dispersal but are capable of infesting soybean fields within several miles. Thus, “long distant” crop rotation can reduce damage in areas where soybean and sunflower acreage is limited. This strategy may lose its effectiveness in areas where regional acreage is to the extent that adults can readily find soybean fields. Still, practices such as avoiding growing soybean in rotation with soybean or sunflower, or in fields adjacent to commercial sunflower fields, should be implemented.

- ***Soybean Varieties.*** Although attempts have been made to locate soybean varieties with resistance to stem borer infestation, researchers have not yet been successful in identifying any *Dectes* resistant commercially available cultivars. Observations in Kansas have, however, shown that girdling, and associated yield losses from lodging, are greater in short season varieties. Longer season varieties allow more time to harvest before lodging occurs, and therefore provide a longer time period between plant maturity and when the crops must be harvested in order to avoid yield losses.

- ***Sunflower Trap Crop.*** Research has shown that stem borers prefer sunflower to soybean, as sunflower is a better host plant. Pupae collected from soybean weighed less than those from sunflower stalks, and adults that fed on sunflower lived longer than those that fed on soybean. Larger stalk diameter of sunflower plants has been suggested as the primary cause of pupae size differences between the two plants. Additionally, sunflower is considered nutritionally more suitable, which may also contribute to larger insect sizes. Because of their affinity for sunflower, it has been suggested that it could be used as a trap crop to lure adults that would otherwise colonize soybean fields, subsequently reducing infestation levels within the field. However, research examining the use of sunflower trap crops was conducted in an area where sunflower is commercially grown as a major cash crop. It is possible that stem borers in these areas may have developed a greater affinity for sunflower. This calls into question whether stem borers would be similarly attracted to sunflower in areas where sunflower production is low and soybean is prevalent. Thus, any attempt to use sunflower as a trap crop should be limited until the usefulness of this strategy has been better determined.

- ***Stubble Destruction.*** Destroying or burying stubble where stem borer larvae overwinter has been recommended as a management option. Fall tillage can significantly increase overwintering mortality and, if disking, several passes may be required. An earlier field study conducted in North Carolina showed that burying stems in the fall enhanced larval mortality, but that spring burial had a negligible impact on larval mortality. Plant stubbles should be buried at least 2-3 inches below the soil surface. This practice may not be appropriate in areas where soil erosion is a concern and stubble is needed for soil conservation and/or compliance with requirement for minimum residue coverage. Additionally, this tactic is incompatible with current conservation farming practices such as no-till farming.

- ***Timely Harvest.*** If fields are infested with stem borer larvae, they should be harvested promptly when plants reach maturity and before girdling occurs. Delayed harvesting can result in significant losses due to lodging. Losses have been reported to be greatest when harvest is delayed and lodging of girdled plants is worsened by windy conditions. Harvesting 2-3 days early has been reported to reduce losses caused by girdling and stem breakage since, in the absence of lodging, soybean stem-borers rarely cause noticeable yield reductions. Therefore, fields that have shown damage from soybean stem borers in the past should be closely monitored in August and September. Those found to contain extensive stalk tunneling are most at risk for lodging and yield losses, and should be harvested first. Further, plants that are infested late in the season may not have enough time to reach the "girdling stage" if harvested quickly at maturity. It should be noted that harvesting soybeans 2-3 days before plants reach the desired 13% moisture content is often not desirable. However, with careful combine adjustment and slower harvesting speeds, harvesting a 95% leaf drop field with a known *Dectes* infestation 2-3 days early can significantly reduce yield losses associated with girdled/lodged plants.

- ***Biological Control.*** Several parasitic wasps, which lay their eggs inside the larva of stem borers, have been reared from larvae collected in the field. However, rates of attack from parasitoids appear to be low. Still, discovery of parasitoids of stem borer larvae offers opportunity for researchers to determine if they can play a valuable role in stem borer suppression and if producers can use biological control as a legitimate management option.

- ***Row spacing.*** Row spacing has not be shown to affect the severity of stem borer infestations or the number of lodged plants. However, yield losses from lodging may be reduced in fields with narrow rows.

This occurs because lodged plants are more likely to be held upright by neighboring plants. Thus, allowing the combine to retrieve the beans with greater harvesting efficiency.