UNIVERSITY OF MARYLAND EXTENSION | AgFS Agriculture & Food Systems

extension.umd.edu FS—1196 | June 2022

DECTES STEM BORER MANAGEMENT IN SOYBEANS

Scientific name
Dectes texanus LeConte

Order
Coleoptera

Family
Cerambycidae

Figure 2. Soybean crop stubble that has been split open, revealing the Dectes stem borer larva within. Photo: Alan Leslie

Description

The Dectes stem borer (DSB) is a longhorn beetle that is native to North America, and feeds on many wild and some cultivated plant species. Common plant hosts for DSB include wild and cultivated sunflowers, cocklebur, common and giant ragweed, and soybeans. Adult beetles are 3/8 to 3/4 of an inch long, grey, and have long antennae that are banded black and grey (Fig. 1). Adults are active during the day, and frequently seen on upper canopy leaves. They will "squeak" if restrained. The legless larvae reach 1/2 to 5/8 of an inch long, are creamy white or yellow in color, and have an "accordion -like" appearance (Fig. 2).

Figure 1. Adult Dectes stem borer on sunflower leaf. Photo: Alan Leslie

Damage

There are three general areas of the United States in which DSB is considered a significant pest. The first area is the coastal plain from South Carolina to the Delmarva Peninsula of Delaware, Maryland, and Virginia, where it is considered a significant pest in isolated areas on the peninsula. The second region is along the Mississippi and Ohio Rivers from Arkansas and southern Missouri to western areas of Tennessee and Kentucky. The third region is from the Texas and Oklahoma panhandles and Kansas to eastern Nebraska (Buschman and Sloderbeck, 2010). Continuous soybean production favors DSB populations.

Significant soybean yield losses from the DSB can be attributed to the overwintering behavior of the larva, which girdles the stem and makes plants prone to lodging. Plant lodging occurs when plants break near the base of the main stem and fall to the ground, which makes mechanical harvest by combine difficult (Fig. 3). Lodging losses can be extremely variable. Fields with 100% stem infestation can suffer anywhere from limited lodging losses to nearly 100%, but the most commonly cited statistic in a heavy pressure situation is 15 bushels per acre. Physiological losses due to the tunneling activity of the larvae during the growing season have been difficult to document, with estimates ranging from 0% to as high as 10% (Leslie et al., 2017; Gomes, 2009).

Figure 3. Left: A soybean plant that was lodged due to DSB girdling the base of the stem. Right: Infested soybean plants that are laying on the ground. Photos: Alan Leslie and David Owens

Figure 4. Left: A girdled stem with frass plug and smooth break characteristic of DSB infestation. Right: An uninfested stem cut by a combine; note the uneven break and absence of a frass plug. Photos: Alan Leslie

Studies of physiological yield losses from tunneling in soybean plants from farms on the Delmarva Peninsula have estimated a yield reduction of approximately 4% when DSB larvae were present in a plant at harvest. DSB larvae do not affect pod or seed number, but rather reduce the average seed mass.

Life History and Phenology

DSB adults begin emerging in mid-June and are present in soybean fields until late-August, laying eggs in the petioles and stems of soybean plants. The authors sampled DSB populations in 2018, and found that adult populations peak during the second week of July, while researchers in Nebraska estimated peak July populations coincide with 1400 – 2000 cumulative degree-days (Rystrom, 2015). The authors conducted cage studies of overwintering DSB larvae in Maryland, which recorded the earliest adult emergence in late June, with peak emergence occurring in mid-July, and final adult emergence in early August.

Adults mate approximately five days after emergence; female oviposition begins 10 – 14 days later (Patrick, 1973). Adults may aggregate in fields for mating purposes but disperse to oviposit (Harris 2019). There is one generation per year. Females lay a single egg into the pith tissue of a soybean petiole by chewing a hole through the plant's epidermis and inserting her ovipositor directly into the plant. Once the egg hatches, the larva tunnels within the soybean plant feeding on pith tissue. As the plant begins to senesce, as early as late September, the larva moves to the base of the plant to create an overwintering chamber. It is rare for there to be more than a single larva in a stem. If two larvae meet each other, they apparently fight to the death for this coveted overwintering spot. A larva will secure its claim by girdling the inside of the host plant several inches above the soil surface and depositing a frass plug immediately below the girdled area of the stem. Girdled stems are weak and often break just above the chamber, leaving an even break that is sealed rather than hollow (Fig. 4). After overwintering, the larvae pupate in early summer, completing the life cycle.

DSB are also commonly found in cultivated and wild sunflowers as well as cocklebur and ragweed weed hosts. Their size and longevity are greatest when reared in sunflowers in comparison to soybeans (Michaud and Grant, 2005). **DSB populations are favored by lack of rotation (Fig. 5), because they likely move into fields from relatively local overwintering habitats**. DSB can disperse within a field between 328 – 820 ft, with a maximum of 1276 ft observed in mark-recapture studies (Harris, 2019). Other estimates suggest adults can infest soybean fields several miles from the source field (Buschman and Sloderbeck, 2010). In a 2021 survey, DSB infestation was greatest along the edge of the soybean field (where 72% of the stems were infested) and lowest in the middle of the field (100 meters from the edge, where 26% of the stems were infested). In addition, our surveys of infested soybean plans on the Delmarva Peninsula indicate that soybean plants with wider stems are more likely to be infested, suggesting that DSB either selects larger plants for oviposition or that larvae have a greater survival rate in higher-yielding soybean plants with wider stems.

Sampling and Decision Making

Currently, no established threshold for DSB in soybeans exists. Sweep net sampling can be used from late June through mid-August to identify fields that have DSB adult activity. Plants can also be visually inspected for

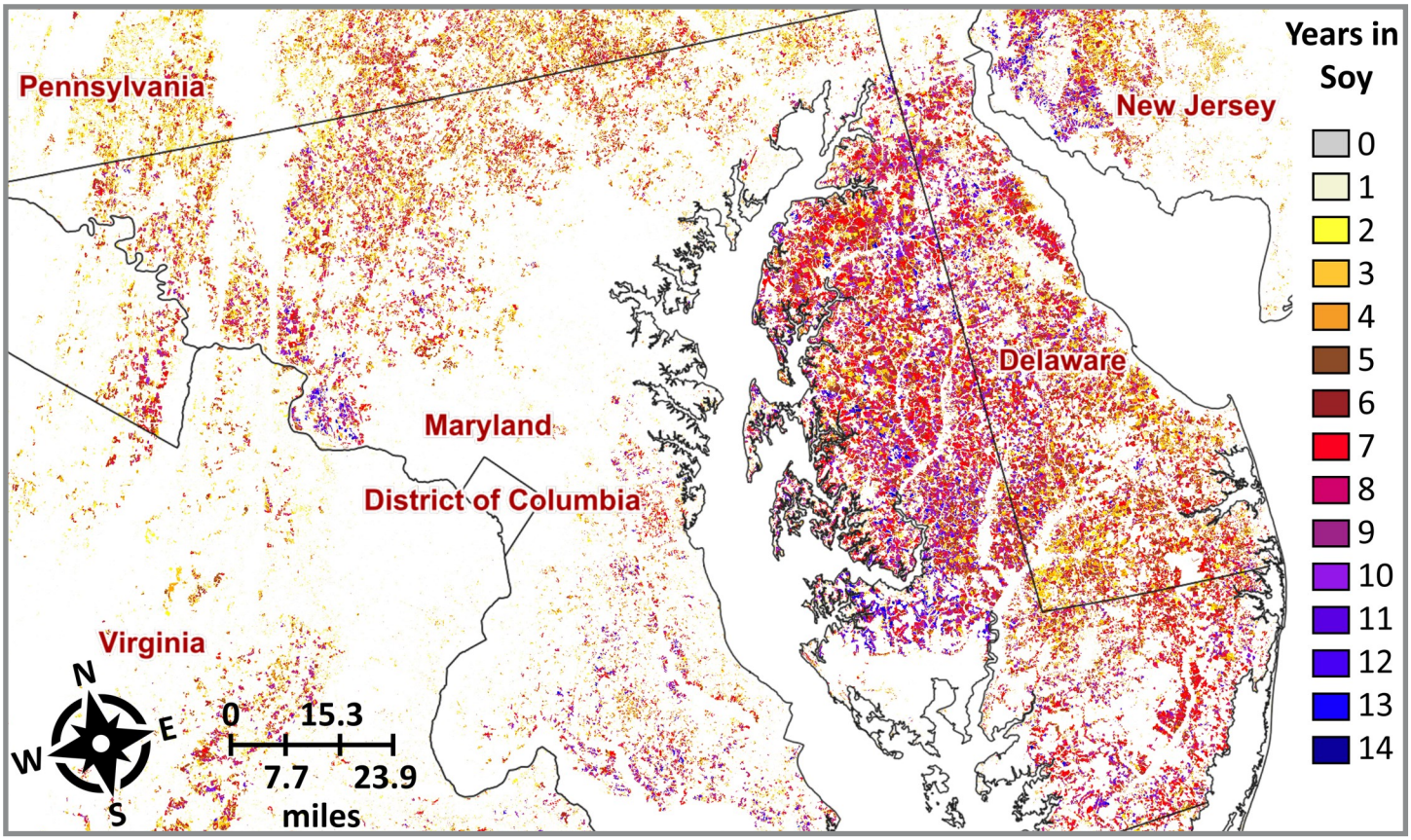

Figure 5. Cropland data layer depicting the frequency a given field has been in soybean from 2008-2021. These areas are at greatest risk for DSB and coincide with published geographic hotspots. Red, blue, and purple represent areas with 7+ years in soybean. Source: USDA NASS CropScape Cropland Data Layer, https://nassgeodata.gmu.edu/CropScape/

oviposition scars. Use wilted petioles or reddish scars where the petiole dropped from the plant to identify fields with potential larval infestations (Fig. 6).

To confirm that a plant is infested with a DSB larva and to assess the risk for lodging loss, cut it lengthwise with a pocketknife by mid-September, looking for the larva and/or feeding damage. It is important to know if a field is infested with DSB and the severity of the infestation because the field may be prone to lodging and should be harvested in a timely manner to reduce the risk for lodging losses.

Figure 6. Soybean plant with wilted leaves, which typically happens after Dectes stem borer larvae consume pith from the petiole and begin tunneling into the main stems of the plant. Photo: David Owens

Management

Insecticides

It is unclear when DSB activity would justify an insecticide treatment. Most research suggests that multiple insecticide applications would be necessary to significantly reduce adult populations and prevent stem infestations. Most work has been done with pyrethroids. There are supplemental pesticide labels (2ee recommendations) allowing Prevathon (20 fluid ounces) and Prevathon (14 fl. oz.) + Steward (6 fl. oz.) to be applied at 1500 growing degree days, with a potential second application necessary, but this application would be extremely expensive and is problematic for reasons outlined below. Mississippi and Nebraska trials testing Prevathon did not reduce stem infestation (Cook and Gore, 2016; Rystrom et al., 2015). In Kansas, two

pyrethroid applications, starting at peak adult activity and spaced 10 days apart, resulted in 46 – 75% reduction in stem infestation (Sloderbeck and Buschman, 2011).

However, it is difficult to recommend insecticide applications targeting DSB due to the very inconsistent relationship between adult counts, stem infestation, and lodging loss. Furthermore, DSB is active at a time of the year in which very few other pests are present. A University of Delaware (UD) trial evaluated DSB management with single and double pyrethroid applications several times in both small plot and large field plot trials. In 2010, one and two applications of insecticides starting when DSB density had reached 1 beetle per 10 sweeps reduced adult counts on subsequent sampling visits, but stem infestation and lodging were NOT reduced (Whalen and Cissel, 2010). Researchers in Kansas reported a similar lack of correlation between beetle counts and stem infestation and therefore discouraged the use of a nominal 1 beetle per 10 sweeps threshold (Sloderbeck and Buschman, 2011). In UD's 2009 trials, two locations were treated with pyrethroids on July 14. In Bridgeville, stem infestation was reduced by 47%. Despite a 77% stem infestation in untreated check plots, only 2% of yield potential was estimated to have been lost through lodging (estimated by gathering and threshing lodged stems as a percentage). In Georgetown, treatment did not reduce infested stem percentages, and a 26% stem infestation resulted in a 0.8% lodging loss (Whalen and Cissel, 2009). These researchers had similar results from a 2016 study (Sylvester et al., 2016). In a UD trial in 2010, plots with as high as 85% infested stems resulted in a 9% lodging loss, while plots with a 53% stem infestation resulted in an 18% lodging loss (Whalen and Cissel, 2010). Furthermore, the Middletown 2010 location had three times as many peak DSB sweep counts than the Georgetown 2010 location, yet had 28% fewer infested stems (40.8% vs 68.3%). In other studies, fields with as much as 100% infested stems lost 16.8% yield from lodging (Daugherty and Jackson, 1969).

Cultural Control

Girdling by DSB can be delayed if senescence is delayed, as would occur in cooler, wet years and with later soybean maturity groups (Michaud et al., 2009). UD trials suggest that early maturity group soybeans are at greater lodging risk. Fields that have been identified as having elevated DSB activity, either through sweep samples or visual observation of flagged petioles, should be prioritized for harvest. If harvest is delayed in these fields, there is a greater chance that windy or rainy weather will cause DSB girdled stems to lodge. Burying fall residue at least 2 inches below the soil surface can reduce DSB adult emergence by 50 – 86% (Campbell and Van Duyn, 1977). Disking should be done twice shortly after harvest. Wet weather and soils as well as soils that form a crust may reduce both survivorship and the successful emergence of adults. Ragweed, cocklebur, and wild sunflower management may help reduce DSB refuge. Narrow row spacing (7 – 15 inch rows) may help reduce lodging losses as lodged plants are somewhat held up by neighboring plants, when compared to wide row soybeans (≥30 inch row spacing).

Host Plant Resistance

No commercial soybean lines are resistant to DSB, although researchers from Kansas State University found a few experimental lines showed resistance to DSB in lab trials. Traits from these experimental lines may be bred into commercial soybean varieties in the future, providing host-plant resistance as a way to manage DSB (Niide et al., 2012). Another research group at Kansas State University tested soybeans that were genetically modified to express RNAi that interferes with DSB genes, which showed promising results in the lab (Smith et al., 2016).

Trap Cropping

DSB is highly attracted to sunflowers (Fig. 7). Experiments in Kansas indicate that dry corners of pivot-irrigated fields planted with sunflowers can reduce DSB infestation in soybeans by as much as 65%; this effect may be greater if sunflowers surrounded a soybean field (Michaud et al., 2007). Over the last several seasons, UD surveys of sunflowers near soybeans have consistently found large numbers of DSB on sunflowers before pollination is completed. Sunflowers might be useful as a trap crop if planted between population sources (i.e., between the previous year's soybeans and the current year's soybeans (Fig. 8). For example, a Delaware farmer in 2021 planted a single row of Clearfield sunflowers in a field of what was the previous year's soybean. More than 30 DSB per plant were removed from the field between July 18 and July 27.

While this strategy sounds promising, care must be taken to prevent a trap crop or sunflower plot from becoming a source population. Stem residue should be aggressively tilled under. Once pollination is complete and sunflowers begin to fill seed, DSB adults apparently leave for better

Figure 7. Dectes stem borer adult on a sunflower petal. Photo: David Owens

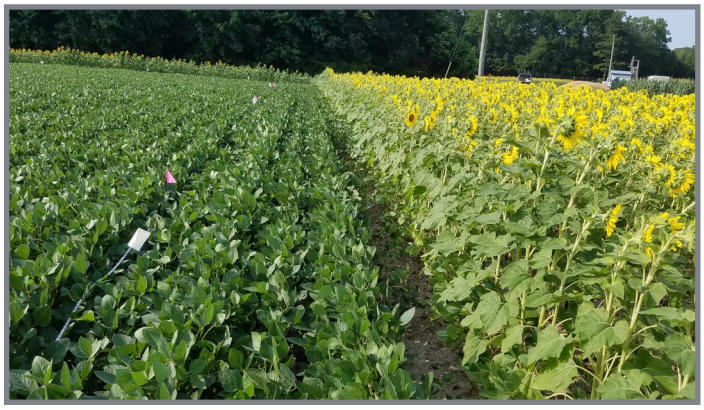

Figure 8. Sunflowers planted between a field previously planted with soybeans and one currently planted with soybeans. This arrangement may attract Dectes stem borer adults to the sunflower plants, and keep them from infesting soybean plants. Photo: David Owens

hosts, including soybeans. On the Delmarva, sunflowers may be able to provide additional, if unconventional, revenue through hunting plots, agritourism, and the cut flower trade. To our knowledge, a seed industry has not been established locally.

Conclusion

Prevention is key for managing DSB. Fields with a history of DSB lodging should not be planted in soybeans continuously. Use narrow-row spacing, and avoid early maturing varieties (group III and early IV). Double-crop soybean is less at risk for lodging losses. If a field experiences severe lodging and the field will be planted into soybeans the following year, fall disking or tillage will help reduce overwintering DSB. Planting sunflowers along the closest field margin may protect soybeans planted near or adjacent to a previously infested field (which may serve as a source population). These sunflowers should be heading or flowering during the first few weeks in July. Such a sunflower patch might only need to be a few rows, and stubble should be destroyed either in early August or in the fall with burial. Studies suggest that pyrethroid applications to soybeans have most consistently reduced DSB populations, although due to the inconsistent nature of DSB presence, infestation, and lodging, it is far from clear whether such an application would pay for itself. Such an application might be most effective when timed to coincide with 1400 – 2000 cumulative degree-days or around the second week of July (per local observation), although this has not been rigorously tested in our region. Finally, if crop scouting finds a significant DSB infestation (such as from adult counts in sweep nets, or wilted petioles and leaflets), harvesting the field should be a priority to reduce the length of time that fall weather events have to lodge the beans.

Acknowledgments

Many thanks are due to Joanne Whalen and Bill Cissel, who authored the original version of this fact sheet. Joanne reviewed the current version, and has worked many years with DSB helping Delmarva farmers with this challenging pest.

References

Buschman, L. L. and P. E. Sloderbeck. 2010. Pest status and distribution of the stem borer, *Dectes texanus*, in Kansas. Journal of Insect Science 10: 198. https://doi.org/10.1673/031.010.19801

Campbell, W. V. and J. W. Van Duyn. 1977. Cultural and chemical control of *Dectes texanus* on soybeans. Journal of Economic Entomology 70: 256-258. https://doi.org/10.1093/jee/70.2.256

Cook, D. R. and J. Gore. 2016. Efficacy of selected insecticides against Dectes stem borer in soybean, 2015. Arthropod Management Tests 41: tsw038. https://doi.org/10.1093/amt/tsw038

Daugherty, D. M. and R. D. Jackson. 1969. Economic damage to soybeans caused by a cerambycid beetle. Proceedings: North Central Branch, Entomological Society of America 24.

Gomes, I. 2019. Biology and management of the soybean stem borer, *Dectes texanus* LeConte, in Kentucky. Thesis. University of Kentucky.

Harris, A. 2019. Spatial distribution of adult *Dectes texanus* (Leconte, Coleoptera: Cerambycidae) and its effects on Kansas soybean (Glycine max L.). Dissertation. Kansas State University.

Leslie, A., K. Hamby, E. Zobel, V. Johnson, and C. Hooks. 2017. Developing a management program for the Dectes stem borer (*Dectes texanus*) by finding and targeting its weak link. Maryland Soybean Board final report.

Michaud, J. P. and A. K. Grant. 2005. The biology and behavior of the longhorned beetle, *Dectes texanus* on sunflower and soybean. J. Insect Sci. 5: 25.

Michaud, J. P., J. A. Qureshi, and A. K. Grant. 2007. Sunflowers as a trap crop for reducing soybean losses to the stalk borer *Dectes texanus* (Coleoptera: Cerambycidae). Pest Management Science. 63: 903-909 https://doi.org/10.1002/ps.1422

Michaud, J. P., P. W. Stahlman, J. L. Jyoti, and A. K. Grant. 2009. Plant spacing and weed control affect sunflower stalk insects and the girdling behavior of *Dectes texanus* (Coleoptera: Cerambycidae). Journal of Economic Entomology 102: 1044-1053. https://doi.org/10.1603/029.102.0324

Niide, T., R. A. Higgins, R. J. Whitworth, W. T. Schapaugh, C. M. Smith, and L. L. Buschman. 2012. Antibiosis resistance in soybean plant introductions to *Dectes texanus* (Coleoptera: Cerambycidae). Journal of Economic Entomology 105: 598-607. https://doi.org/10.1603/EC11253

Patrick, C. R. 1973. Observations on the biology of *Dectes texanus texanus* (Coleoptera: Cerambycidae) in Tennessee. Journal of the Georgia Entomological Society 8: 277-279.

Rystrom Z. D. 2015. Seasonal activity and sampling methods for the Dectes stem borer, *Dectes texanus* Leconte, in Nebraska soybeans. Thesis. University of Nebraska.

Rystrom, Z. D., R. J. Wright, T. A. DeVries. 2015. Effect of Prevathon insecticide on Dectes stem borers, brown stink bugs, grasshoppers, lepidopteran larvae, minute pirate bugs, spiders, and nabids in soybean, 2014. Arthropod Management Tests 40: F37. https://doi.org/10.1093/amt/tsv166

Sloderbeck, P. E. and L. L. Buschman. 2011. Aerial insecticide treatments for management of Dectes stem borer, *Dectes texanus*, in soybean. Journal of Insect Science 11: 49. https://doi.org/10.1673/031.011.4901

Smith, C. M., B. McCornack, W. Schapaugh, and J. Whitworth. 2016. Development of genetic, chemical, and population-based tactics to manage key Kansas soybean pests. Kansas Soybean Commission 3rd quarter progress report. Nov. 30.

Sylvester, P., B. Cissel and J. Whalen. 2016. Area wide evaluation of multiple insecticide applications to control Dectes stem borer in soybeans-another try! 2016 Delaware Soybean Board report. https://www.udel.edu/content/dam/udelImages/canr/pdfs/extension/sustainable-agriculture/2016-Delaware-Soybean-Board-Final-Report.pdf

Whalen, J. and B. Cissel. 2009. Dectes stem borer management in soybeans. https://www.udel.edu/content/dam/udelImages/canr/pdfs/extension/sustainable-agriculture/pest-management/2009-Insect-Management-Trials.pdf.

Whalen, J. and B. Cissel. 2010. Dectes stem borer insecticide trial. https://www.udel.edu/content/dam/udelImages/canr/pdfs/extension/sustainable-agriculture/pest-management/2010-Insect-Management-Trials.pdf.

Whalen, J. and B. Cissel. 2010. Dectes stem borer variety trial. https://www.udel.edu/content/dam/udelImages/canr/pdfs/extension/sustainable-agriculture/pest-management/2010-Insect-Management-Trials.pdf.

KELLY HAMBY
kahamby@umd.edu

ALAN LESLIE
aleslie@umd.edu

DAVID OWENS
owensd@udel.edu

This publication, *Dectes Stem Borer Management in Soybeans* (FS-1196) is a part of a collection produced by the University of Maryland Extension within the College of Agriculture and Natural Resources.

The information presented has met UME peer-review standards, including internal and external technical review. For help accessing this or any UME publication contact: itaccessibility@umd.edu

For more information on this and other topics, visit the University of Maryland Extension website at extension.umd.edu