Banded Sunflower Moth

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Introduction

The banded sunflower moth, *Cochylichroa hospes* (Walsingham) (Lepidoptera: Tortricidae), is an annual pest of commercial sunflowers in the Dakotas (Charlet and Busacca 1986). In recent years, this pest has been more of an issue in North Dakota than in South Dakota and has been relatively minor there. Many previous reports on the banded sunflower moth suggest that it is often present in sunflowers at subeconomic populations (Shulz 1978). However, historical records from South Dakota indicate that the banded sunflower moth has been a major pest, with seed damage comparable to that caused by the red sunflower seed weevil (Smolek et al. 1985). Banded sunflower moth caterpillars feed on developing kernels, causing seed damage and reduced marketability of sunflower seeds.

Identification

Egg (Schulz 1978) (Figure 1):

- Approximately 0.51 mm in diameter
- Round to oval shape and semi-flattened
- White

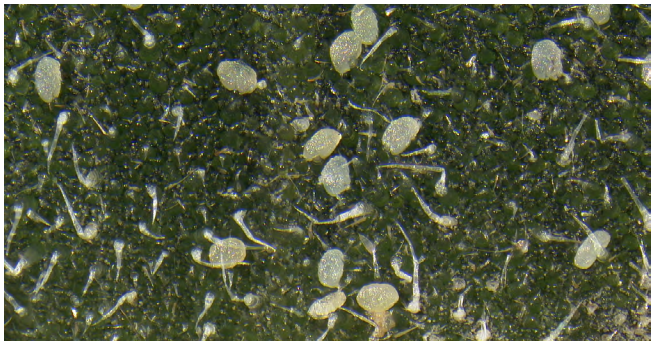

Figure 1. Banded sunflower moth eggs on bud stage bracts. Photo courtesy of Kirk Mundal, North Dakota State University Extension.

Caterpillar (Shulz 1978) (Figure 2):

- Five instars/caterpillar growth stages
- Dark brown head capsule
- Newly hatched caterpillars are white and approximately 1 mm in length
- As the caterpillars develop, body color changes from light pink or yellow to red or purple, and green during the last instar
- Fifth (last) instar caterpillars are approximately 10 mm long

Figure 2. Banded sunflower moth caterpillars at different instars. Photo courtesy of North Dakota State University Extension.

Pupa (Shulz 1978) (Figure 3):

- Pill-shaped
- Light to dark brown puparium
- Approximately 6-6.35 mm long
- No appendages
- Present in the soil, before adult emergence, the pupa pushes itself close to the soil surface

Figure 3. Banded sunflower moth pupa. Photo courtesy of Kirk Mundal, North Dakota State University.

Adult (Walsingham 1884, Westdal and Barrett 1955) (Figure 4):

- Small moth with a wingspan of approximately 5-13.5 mm
- White in color with orange-brown colorations on the body (straw-colored specks)
- Distinguished by a darker orange-brown band with silver flecks located in the center of the forewings
- Hind wing is light gray/brown with no distinct markings
- Forewings fold in a tent over the body when the moth is at rest
- Forewings with fringe on posterior edge

Figure 4. Banded sunflower moth. Photo courtesy of Patrick Beauzay, North Dakota State University.

Lifecycle

The banded sunflower moth has a single generation each year (Beregovoy and Riemann 1987). Adults begin emerging from the soil of the previous sunflower crop in July, and oviposition (egg laying) occurs through late August (Westdal and Barrett 1955, Schulz 1978). Early instar banded sunflower moth caterpillars remain active on cultivated and wild sunflower heads until late September (Beregovoy and Riemann 1987, Knodel, personal observation). Eggs are laid on bud bracts and the back of the sunflower head (Beregovoy and Riemann 1987). Egg hatch occurs 5-8 days after oviposition, and caterpillars are active on sunflower heads for about three weeks (Westdal and Barrett 1955, Shulz 1978). Upon completing the last instar, the caterpillars drop off the sunflower head and burrow approximately 5 cm into the soil near the base of the plant (Westdal and Barrett 1955). Once at an appropriate depth, the caterpillars spin a cocoon for overwintering, until pupation occurs in late June of the following year (Westdal and Burrett 1955).

Scouting

Peak moth abundance is generally observed during the third week of July (21st to the 24th). This is typically close to the R3 (bud more than one inch from the closest leaf) or R4 (bud opens and ray petals just visible) growth stage (Beregovoy and Riemann 1987, Charlet and Gross 1990). There is evidence that banded sunflower moths prefer sunflowers that are not in flower, as oviposition declines with increased pollen availability (Barker and Grugel 1996). Peak caterpillar abundance occurs between August 5th and August 18th (Charlet and Gross 1990). Initially, populations that exceeded the economic injury level were identified by scouting 100 plants per field for banded sunflower moths (Charlet et al. 2002). This method requires sampling 20 plants from five sampling sites per field, including the field corners and the center of the field, during either late morning or early afternoon (Charlet et al. 2002, Mundal et al. 2006). Each sampling site should be approximately 75-100 feet from the field margin to accurately estimate the field average (Charlet et al. 2002). Each plant being sampled should be examined for banded sunflower moths resting on the upper or lower leaf surfaces.

An alternative method was later developed to determine economic injury levels based on the number of eggs per bract (Mundal and Brewer 2008). Banded sunflower moth populations tend to be more concentrated within 15-20 feet of the field edge (Beregovoy and Riemann 1987, Mundal and Brewer 2008). As a result, Mundal and Brewer (2008) developed an economic distance injury level that predicted how far into a field economic egg densities reach. This method allows for a more targeted

insecticide application. To determine the threshold based on egg count, sample five random buds approximately 18 feet into the field from two sides or halves of the field (Mundal et al. 2006). For each of the buds, a total of six bracts from the outer whorl should be examined for banded sunflower moth eggs, and any eggs that are present should be counted for each plant (Mundal et al. 2006).

Economic Impact and Integrated Pest Management

Previous research determined that the caterpillars are active for approximately 6-10 weeks. During that time, each caterpillar can potentially destroy 6-7 seeds (Charlet and Gross 1990). The caterpillars chew a hole in the developing pericarp and consume a portion of the kernel or the entire kernel (Peng and Brewer 1995). For each potential sampling method, insecticide management for the banded sunflower moth is based on dynamic economic injury levels that respond to current sunflower market value, insecticide costs, and plant population/seeding rate (Charlet et al. 2002, Mundal et al. 2006, Mundal and Brewer 2008). As a result, the economic injury level must be calculated annually for each field. The economic injury level equation for moths per 100 plants is presented below (Charlet et al. 2002):

$$EIL\ \left(Moths\ \ per\ \ 100\ \ plants\right)\ \ =\ \ \left(\frac{Treatment\ \ Cost/Market\ \ Value}{Seeding\ \ Rate}\right)\times 582.9\ \ -\ \ 0.7\Bigg)$$

The only variables in this equation that require adjustment are the treatment cost, market value, and seeding rate for the field. When those are input into the equation, the economic injury level can be calculated for number of moths per 100 plants. The calculated value is used to determine if field populations require insecticidal management.

The equation for determining the economic injury level based on the number of eggs per bract is below (Mundal and Brewer 2008):

$$EIL\ \left(Eggs\ \ per\ \ Six\ \ Bracts\right)\ \ =\ \ \left(\frac{Treatment\ \ Cost}{(Market\ \ Value\ \ \times\ \ Seeding\ \ Rate\ \ \times\ \ 0.00078)}\right)$$

Then, to apply the calculated economic injury level to determine the economic distance, the following formula can be used (Mundal and Brewer 2008):

$$Economic\ \ Distance\ \ =\ \ \ e\ \left(\frac{\left(\frac{EIL}{Observed\ \ Eggs}\right)\ \ -\ \ 1.458}{-0.262}\right)$$

This will provide an estimate of how far the economically damaging population of banded sunflower moth extends beyond the sample site along the edge of the field.

Planting date has been evaluated as an alternative management option. Oseto et al. (1989) found that banded sunflower moth seed damage was much higher for sunflowers planted during early May compared to late May and early June. Prasifka et al. (2016) did not observe similar reductions across all years and locations during a planting date study. During one year of the study for their Nebraska location, they observed decreased banded sunflower moth damage in later planted sunflower (Prasifka et al. 2016). It's important to note that the banded sunflower moth seed damage observed by Prasifka et al. (2016) was approximately 68% lower than in the study by Oseto et al. (1989).

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