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# Soybean Gall Midge and White-mold Gall Midge in Soybean

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**T**wo fly midges are associated with soybeans: the soybean gall midge, *Resseliella maxima* Gagné (Figure 1), and the white-mold gall midge, *Karshomyia caulicola* (Coquillett) (Figure 2).

The soybean gall midge is a new economic insect pest of soybeans, which first was reported causing yield losses in Nebraska, Iowa and South Dakota soybean fields in 2018. This pest also was detected in Minnesota in 2018 and Missouri in 2019. The known distribution of soybean gall midge continues to expand in the five infested states, and infestations in South Dakota and Minnesota border southeastern North Dakota.

## **Soybean gall midge has not been detected in North Dakota based on our 2019-2020 surveys.**

A total of 78 fields in 11 counties in 2019 and 605 fields in 47 counties in 2020 were surveyed. Continued monitoring for this pest is crucial to detect its arrival in our state in order to be proactive in its pest management.

During 2019 soybean surveys, the white-mold gall midge was found in Minnesota and North Dakota; however, it is widespread in the northern region of the U.S. This tiny gall midge usually is associated with the fungus *Sclerotinia* spp., or white mold. **The white-mold gall midge is not an insect pest of soybeans**, and it primarily has been reported as a white mold fungus feeder.



**Figure 1. Adult female (left) and male (right) soybean gall midge** (M. Helton, Iowa State University)



**Figure 2. Adult white-mold gall midge** (J. Moisan-De Serres, Laboratoire d'Expertise et de Diagnostic en Phytoprotection, Ministère de l'Agriculture Québec, Canada)

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## Identification

These two gall midges are in the fly family Cecidomyiidae and are similar in appearance. Larval identification of both species is difficult. Larvae easily can be misidentified or confused with larvae of similar gall midge species. Separating the soybean gall midge and white-mold gall midge larvae requires close microscopic examination of their terminal abdominal segments or DNA testing.

### Soybean Gall Midge

Young **larvae** (first and second instars) are white and smaller, whereas the mature third instar larvae (Figure 3) are orange to reddish orange and about 1/12 inch in length. Larvae of soybean gall midge feed on plant liquids by excreting enzymes that digest the plant tissues, sometimes causing galls.

**Adults** (Figure 1) are light to dark brown, small, about 1/8 inch in body length, and mosquito-like flies with an orange abdomen. Their characteristic markings are the white and black banding on the antennae and legs, and mottled wings.

### White-mold Gall Midge

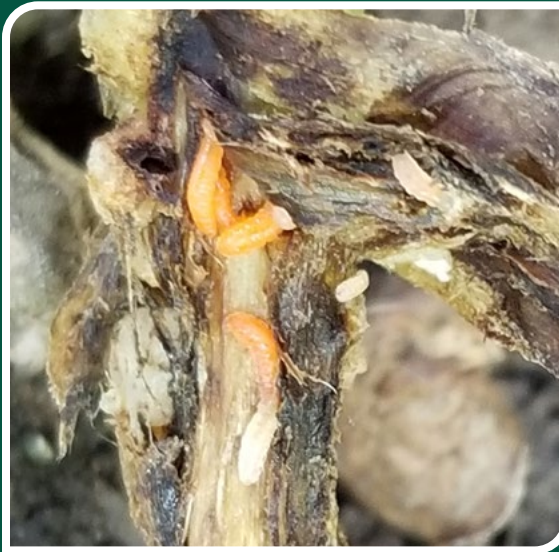
**Larvae** (Figures 4 and 5) are white (first and second instar) to orange (third instar), depending on the age. Larvae are similar in size to soybean gall midge.

**Adults** of white-mold gall midge (Figure 2) have uniformly grayish antennae, wings and legs with a pale orange abdomen. The white-mold gall midges are similar in size to soybean gall midge adults.

## Life Cycle

**Soybean gall midge** likely has two generations per year in northern states. The larva overwinters inside of a larval cocoon (Figure 6) in the soil. Larvae pupate during the spring. The first generation of soybean gall midge adults emerge from mid-June through early July in Minnesota. Adults only live three to five days, and do not feed on soybeans.

Females lay their eggs in crevices or cracks on the soybean stem. Once eggs hatch, larvae begin feeding under the epidermis of the soybean stem and pass through three instars. Numerous larvae sometimes can be found in one soybean stem. Larvae drop off the plant to the soil to form larval cocoons and then pupate. The cycle repeats for the second generation until the fall, when larvae will overwinter as cocoons in the soil.



**Figure 3. Soybean gall midge larvae in stem**

(V. Calles-Torrez, NDSU)



**Figure 4. White-mold gall midge larvae feeding on white mold-infected stem**

(J. Moisan-De Serres, Laboratoire d'Expertise et de Diagnostic en Phytoprotection, Ministère de l'Agriculture Québec, Canada)



**Figure 5. White-mold gall midge larvae feeding on white mold-infected pod**

(B. Potter, University of Minnesota Extension)



**Figure 6. Soybean gall midge larval cocoon from soil**

(V. Calles-Torrez, NDSU)

## Crop Damage (Table 1)

**Soybean gall midge** feeds beneath the epidermis near the base of the stem (Figure 3). Sometimes the base of the stem is necrotic (dark), swollen, deformed and gall-like (Figure 7). Soybean stems heavily infested by soybean gall midge are stunted (Figure 8), wilted, lodged or dead (Figure 9). Significant yield losses have been recorded in states with severe infestations and are most common at the field edges (Figure 9).

The **white-mold gall midge** feeds on *Sclerotinia* species on and within infected stems, pods and other tissues (Figures 4 and 5). This species of gall midge can be found anywhere in the field where soybean plants are infected with *Sclerotinia* white mold fungus (Figures 10 and 11). White-mold gall midge also has been identified in other crops that are susceptible to *Sclerotinia* white mold fungus, such as canola, dry beans, potatoes and sunflowers.

Because this insect does not feed directly on vegetative or reproductive tissues of soybeans, and predominantly feeds on the white mold, growers do not need to control the white-mold gall midge. However, growers should consider managing severe white mold infections in their fields.



**Figure 7. Dark discolorations from soybean gall midge feeding injury at the base of soybean stems** (V. Calles-Torrez, NDSU)

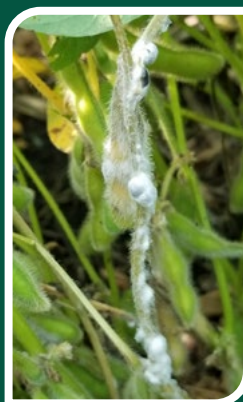
**Figure 8. Stunted plants from soybean gall midge damage** (V. Calles-Torrez, NDSU)



**Figure 9. Dead soybeans from soybean gall midge infestation near field edges** (J. McMechan, University of Nebraska)



**Figure 10. Soybean infected with *Sclerotinia* white mold** (V. Calles-Torrez, NDSU)



**Figure 11. Soybean field with severe *Sclerotinia* white mold. Notice the dead plants in the middle of the field.** (V. Calles-Torrez, NDSU)

**Table 1. Comparison between soybean gall midge and white-mold gall midge: color of larvae, location of larva in field and on plants, plant injury symptoms, and soybean yield impact.**

Description	Soybean gall midge ( <i>R. maxima</i> )	White-mold gall midge ( <i>K. caulicola</i> )
Color of larva	White to reddish-orange	White to orange (often light orange)
When larvae are observed in field	As early as V2 (2nd leaf stage) of soybean (in states with severe infestations)	Later in season, after flowering and onset of <i>Sclerotinia</i> white mold infections
Location of larvae in field	Field edges, especially soybean fields near previous year's soybean	Throughout the field where <i>Sclerotinia</i> white mold is present
Where larvae are located on soybean plant	Under epidermis of stem, at or near base of plant, or higher up on stem later in season	Anywhere on/in <i>Sclerotinia</i> -infected stems and pods
Plant injury symptoms	Necrotic, brown or dark discolorations at the base of plant, some plants with swollen stems. Plants easily broken off at base. Lodging, wilting and dead plants.	None for insect. Disease Symptoms: Stems or pods infested with <i>Sclerotinia</i> , presence of mycelium in stems and on vegetative tissues, dead plants with mycelium.
Yield impact	Because of stunted, dead plants, small pods/seeds, and reduced plant stand, yield can be reduced from 20 to 100%, especially on field edges with heavy infestation.	None. This insect does not cause yield loss. However, <i>Sclerotinia</i> white mold can cause significant yield loss if not managed.

## Field Scouting (Table 1)

### Soybean Gall Midge

Adults are not readily observable in the field due to their cryptic appearance, small size and short life span. Larval-infested stems are easier to find near the field edges of soybeans (Figure 9) or in newly planted soybean fields that are close to last year's infested fields, and during the R2 (full bloom) to R8 (maturity) growth stages of soybeans.

Scout by walking a transect in the first four rows near the field edge and focus in areas where dense vegetation occurs along the field edge. Examine 10 consecutive plants at 10 sampling sites per field (total of 100 plants per field). Sampling sites should be spaced more than 50 feet apart.

At each sampling site, examine plants for the presence of necrosis and brown or dark discoloration at the base and lower portion of each stem (Figure 7). If necrosis is observed, pull up the soybean plant and peel back the outermost layer of the stem (epidermis) on the necrotic area to look for small white or orange larvae.

Growers are encouraged to scout for soybean gall midge. Additional scouting will help detect this economic insect pest of soybeans and determine if or when it becomes established in North Dakota.

### White-mold Gall Midge

To find the white-mold gall midge in soybean fields, you can look for white mold-infected soybean plants, which have white cottony mycelium on the stems, pods and leaves, bleached or dead stems, or dying soybean patches in the field.

If white mold is observed on plants, pull up a few plants and examine for the presence of white to orange larvae in or on infected soybean tissue and mold. If larvae are found directly associated with white mold, then they are most probably the white-mold gall midge.

## What to Do if You Find Suspect Soybean Gall Midge in North Dakota

If you happen to find white or orange larvae in the stems of soybeans, you need to confirm whether it is the soybean gall midge or white-mold gall midge. **Collect more than 10 larvae and place them in alcohol vials, or collect two to three plants with larvae and place them in a plastic bag. Send collected samples to the Extension agent in your county or to NDSU Extension Entomology for further identification.**

## Integrated Pest Management (IPM) of Soybean Gall Midge

Because the soybean gall midge is a newly discovered insect pest, entomologists have been studying different integrated pest management strategies. Studies on planting dates, crop rotation, tillage and insecticide control for this pest are being conducted in states with severe infestations.

## Other Resources

Gagné, R. J., J. Yukawa, A. K. Elsayed, and A. J. McMechan. 2019. A new pest species of *Resseliella* (Diptera: Cecidomyiidae) on soybean (Fabaceae) in North America, with a description of the genus. *Proc. Entomol. Soc. Wash.* 121: 168-177.

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McMechan, J., T. Hunt, and R. Wright. 2018. Soybean gall midge: adult stage identified. University of Nebraska-Lincoln. Available at: <https://cropwatch.unl.edu/2018/soybean-gall-midge-adult-stage-identified>

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