4-2021

Soybean Gall Midge in Nebraska

Anthony J. McMechan

Thomas Hunt

Robert J. Wright

NebGuide

Nebraska Extension

Research-Based Information That You Can Use

G2331 Index: Crops, Insects and Pests
Issued April 2021

Soybean Gall Midge in Nebraska

Justin McMechan, UNL Extension Crop Protection and Cropping Systems Specialist

Thomas Hunt, UNL Extension Entomology Specialist

Robert Wright, UNL Extension Entomology Specialist

Historical Information

Soybean gall midge (*Resseliella maxima* Gagné) was described in 2019 as a new insect species in Nebraska, due to observations of widespread early season injury in eastern Nebraska, eastern South Dakota, western Iowa, and southwest Minnesota soybean fields (Gagné et al., 2019). Since its discovery, soybean gall midge has been causing significant injury and yield losses in soybean in eastern Nebraska. Although only recently identified, soybean gall midge is not likely new to the north-central region of the U.S. In 2011, orange larvae were documented in some isolated fields in northeast Nebraska that had received hail damage during the early half of the growing season. Similar reports were made in 2016 and 2017 in east-central Nebraska. Prior to 2018, reports of orange larvae in soybean were confined to the late reproductive stages of a few dead or dying plants.

In 2018, several observations were made that raised concerns that soybean gall midge should be designated as a pest of soybean (McMechan et al. 2021). Unlike previous years where damaged plants were found later in the growing season, injured plants were observed in late June and early July. Soybean plants with larval presence exhibit signs of wilting and death, with the greatest frequency of symptomatic plants occurring along field borders adjacent to fields that had been planted to soybean the previous year. In many cases, the presence of dense vegetation (trees, uncut bromegrass, and/or shrubs) along field borders was associated with an increased frequency and intensity of plant injury.

As a new species, several knowledge gaps must be bridged in order to development an integrated pest management strategy for soybean gall midge (McMechan et al. 2021) Year-to-year variability in the duration of emergence and injury from soybean gall midge has made it difficult to identify an effective control strategies. In 2018, soybean plants were hand-harvested from a heavily infested field in Saunders County, Nebraska, where a yield loss of 92%, was estimated for a section of the field in the first 100 feet from the field edge (compared to historical yields). Yield losses of 31% and 20% at 200 and 400 feet into the field, respectively, were also recorded (McMechan et al. 2021). Additional yield loss may also occur from early pod shatter from infested plants that mature ahead of the rest of the crop as well as lodging from weakened stems.

As of 2020, soybean gall midge had been found in 114 counties in five states, with 39 counties infested in eastern Nebraska (Fig. 1). The distribution of soybean gall midge has increased each year since its discovery, although the extent of field injury is typically far less in newly identified counties.

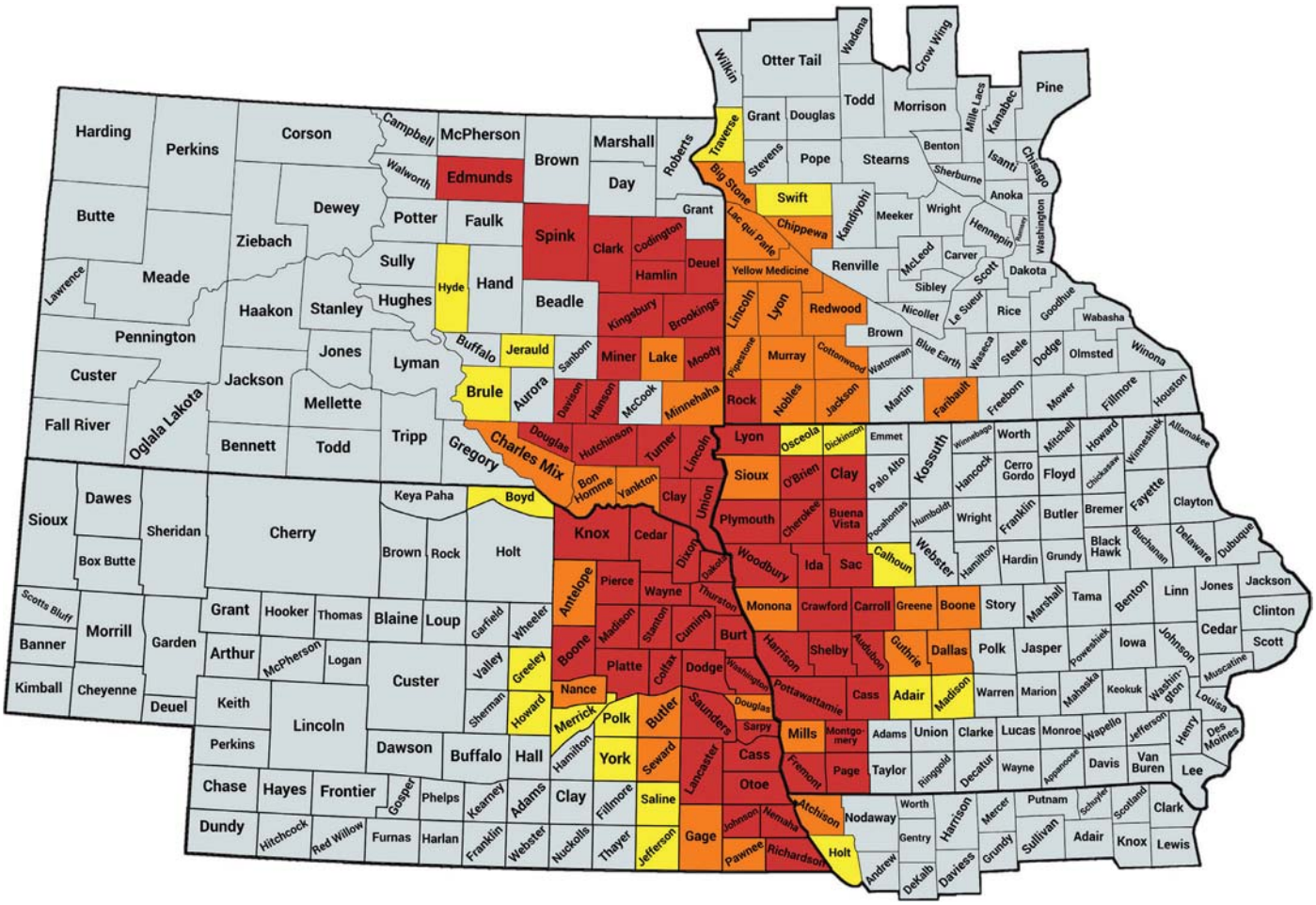

Figure 1. Soybean gall midge distribution by county in 2018 (red), 2019 (orange), and 2020 (yellow).

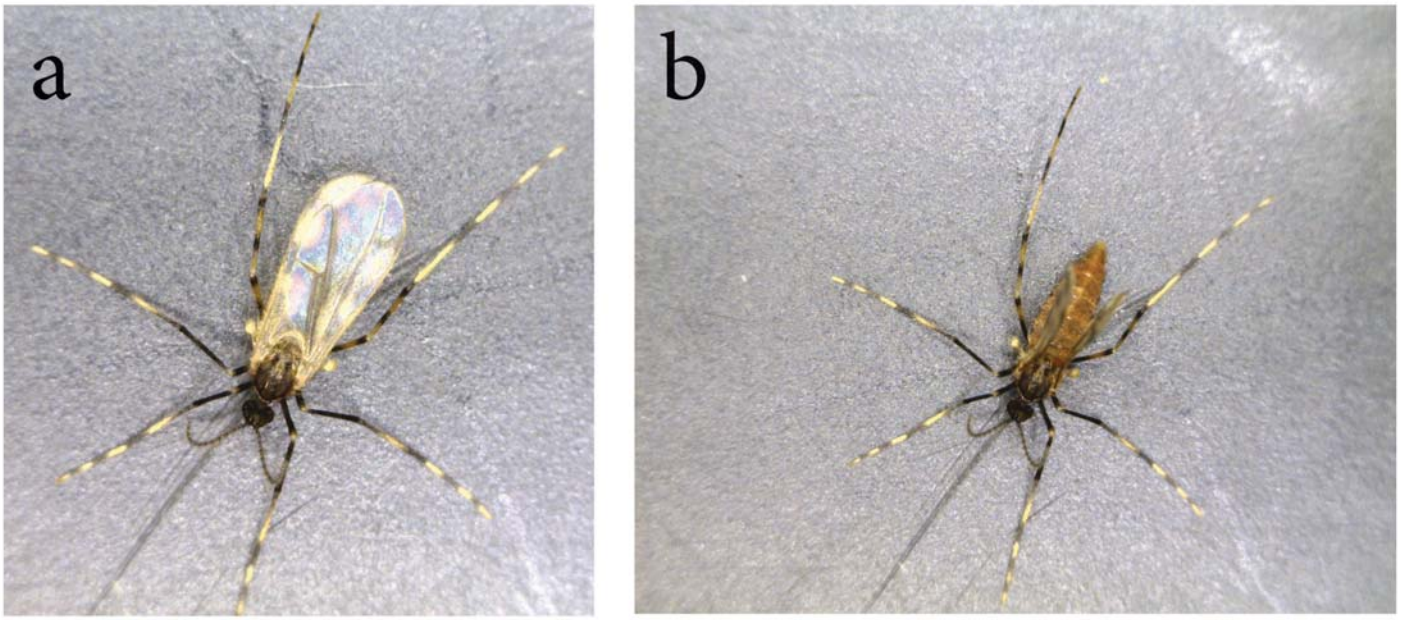

Figure 2. Adult female soybean gall midge with wings over abdomen (a) and abdomen visible (b)

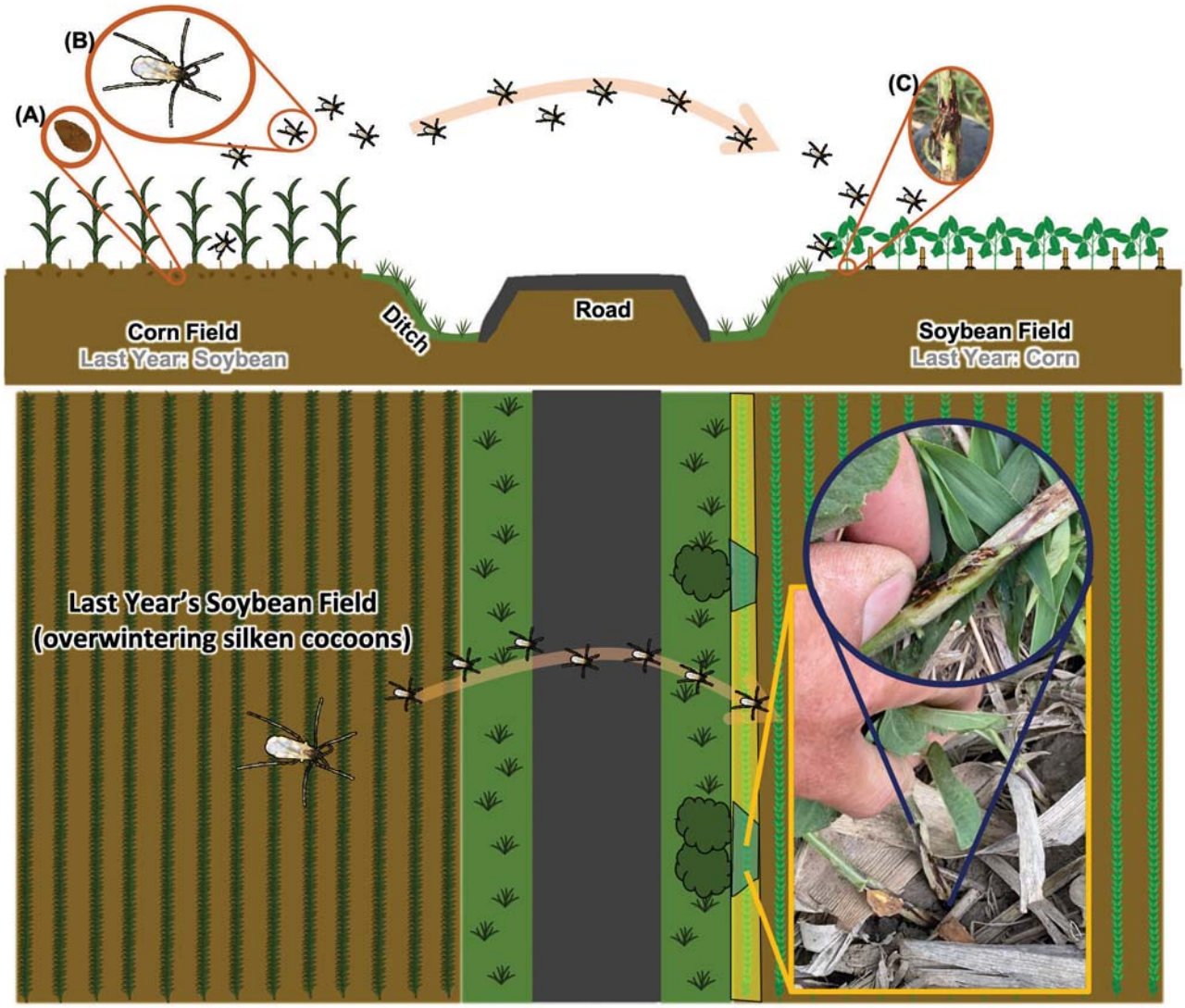

Figure 3. Field landscape showing the previous year's soybean field with overwintering silken cocoons (A), adult emergence from that field (B), and their movement in this year's soybean field in early to mid-June. After 7–10 days, larvae (C) may be found at the base of stems of plants closest to the previous year's soybean field

Soybean Gall Midge Development Stages

Adults

Adult gall midges (Fig. 2) emerge from the previous year's soybean fields (Fig. 3) sometime in early to mid-June.

Long emergence periods pose a considerable challenge for managing soybean gall midge. Adults are not readily visible to the naked eye (1/8-inch in length) and are difficult to collect with sweep nets. Thus, the use of sweep nets in infested fields is not a reliable means of adult detection. Corn rootworm emergence cages with glass jars (Fig. 4) are currently the most effective method for monitoring adult emergence. Information about adult midge emergence and alerts of field infestations are available on the Soybean Gall Midge Alert Network webpage (soybeangallmidge.org).

Larvae

Larvae can be found in soybean plants within 7 to 10 days after the first adults have emerged from the soil. The first two larval instars (growth stages) (Fig. 5) are white, and can be confused with other non-pest insect species.

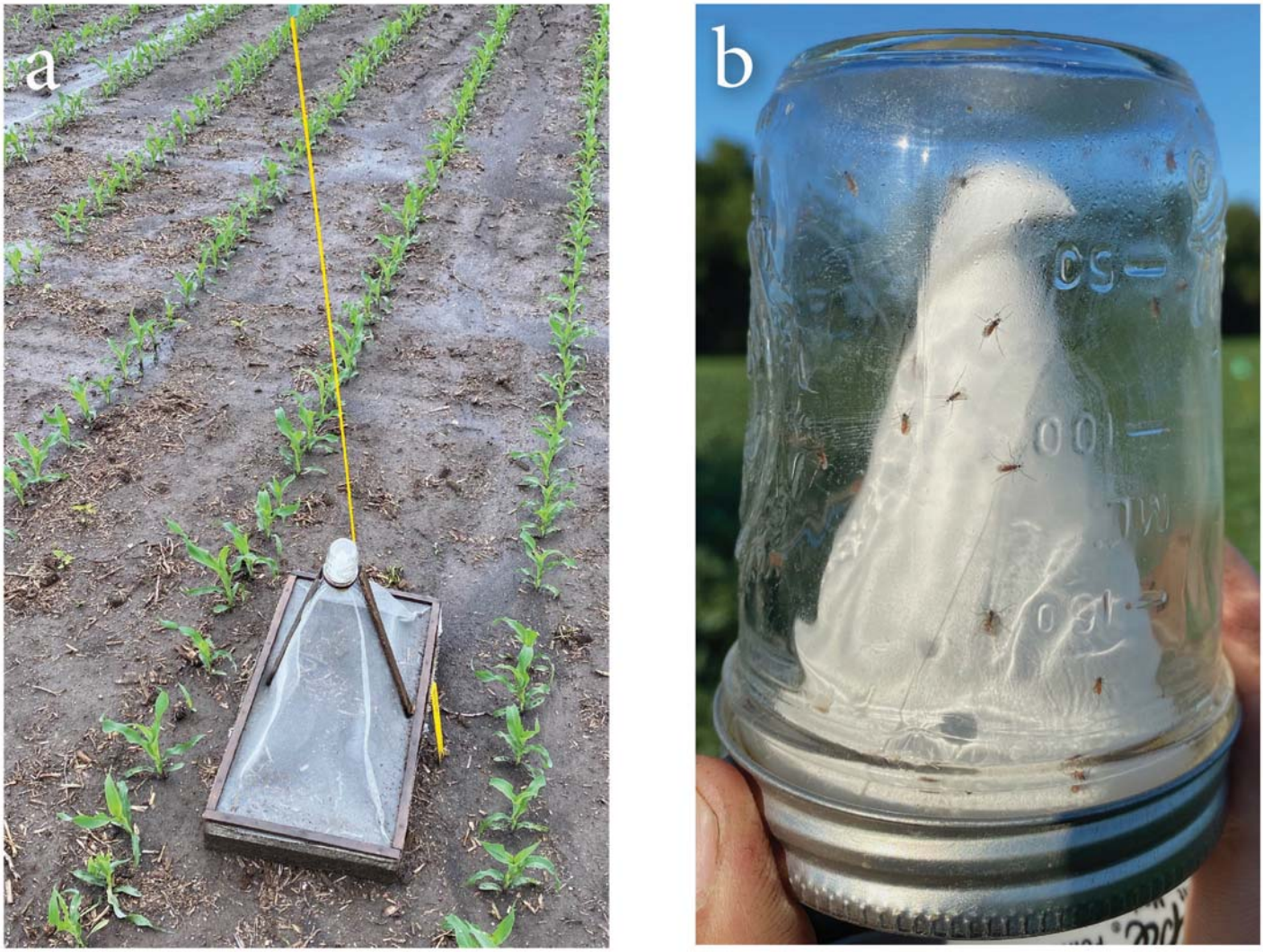

Figure 4. Emergence cage in last year's soybean (overwintering site) field (a), and a mason jar with soybean gall midge adults (b).

A more characteristic feature of a soybean gall midge infestation is the third instar orange larvae (Fig. 6) that can be visible (1/12 of an inch in length) approximately 12 days after the first adult activity occurs. A long duration of adult emergence from overwintering sites means that all stages of the larvae are likely to be found in an infested soybean plant.

Silken Cocoons/Pupae

Although no controlled studies have been conducted, the total lifecycle for soybean gall midge is estimated to be 28 to 32 days, based on field observations. After completing three larval growth stages on the soybean plant, the larvae fall to the ground, burrow into the soil, and form a silken cocoon. The larvae will pupate and emerge as adults to infest soybean plants. In 2019, two complete generations were reported in Nebraska, with a possible third generation. The later-season larvae overwinter in the soil, likely within the silken cocoon, and emerge the following year in early summer.

Scouting

Determining if soybean gall midge is present in a field is a critical first step to determine risk and utilize management strategies when they become available. Several factors can impact the likelihood of finding soybean gall midge larvae, such as the type of adjacent field crop (Fig. 3), planting date, plant development stage, the presence of dense vegetation, and adult emergence period.

Figure 5. White soybean gall midge larvae found at the base of the stem 5–7 days after adult emergence.

Figure 6. Third instar larvae of soybean gall midge on soybean stem at the base of the plan

Soybean Development Stage

Soybean plants that are not at the V2 stage (Pedersen and Licht, 2014) at the time of first adult emergence are unlikely to get infested with soybean gall midge larvae, greatly reducing the risk plant injury. Field observations have found that small fissures (Fig. 7) at the base of the stem below the cotyledonary node are likely necessary for adult egg laying. Although it is not well understood, the timing and extent of fissure development likely vary with soybean variety and planting date. Mechanical injury to stems may also provide egg laying sites. Infestations prior to V2 may be possible if stem injury occurs, but this has not been tested or confirmed in the field.

Field Scouting

Scouting should begin at least 7 to 10 days after first adult emergence is reported through soybeangallmidge.org. For the purpose of early detection, scouting should occur in a soybean field that is directly adjacent to a field that was planted in soybean the previous year (Fig. 7). Field areas with dense vegetation along the edge are particularly good locations to check for initial and early signs of infestation.

Adults do not feed after emergence, but they do need water. It is hypothesized that the dense vegetation at field edges may contain and provide water for longer periods in the morning. Initial larval feeding injury to soybean plants appears as a dark discoloration at the base of the plant below the cotyledonary node. These discolorations initially occur from naturally formed fissures and spread around the stem with additional larval feeding. Peeling back, this tissue may reveal the presence of orange or white larvae (Fig. 7). Orange larvae may not be present in early infestations or shortly after first adult activity in early summer. Based on observations made in 2019, orange larvae can be found within 12 days of adult activity. Approximately 21

Figure 7. Fissure at the base of soybean stem at V2–V3 stage prior to soybean gall midge infestation.

days after a significant infestation, wilting or dead plants may be visible (Fig. 8).

Other Hosts

Soybean gall midge was recently identified on yellow/white sweet clover (Braker 2020) and alfalfa in several eastern Nebraska counties in 2019. Field surveys have found that the larvae are more abundant on sweet clover than on alfalfa. Although present on alfalfa, soybean gall larvae can be difficult to locate, as larvae are usually found in the pith of the stems rather than just under the epidermis. In both cases, larvae have only been found in the second year after the establishment of these hosts. While scouting fields, walk the ditches between soybean fields, looking for either of these hosts. Carefully inspect the stems of the plants for discoloration. Dark or gray discolorations can often be found on infested sweet clover stems (Fig. 9). Infested alfalfa exhibits faint dark discolorations. Currently, no management should be taken on these hosts as means of controlling soybean gall midge. The role and risk of these hosts to subsequent soybean gall midge infestation of soybean is not known.

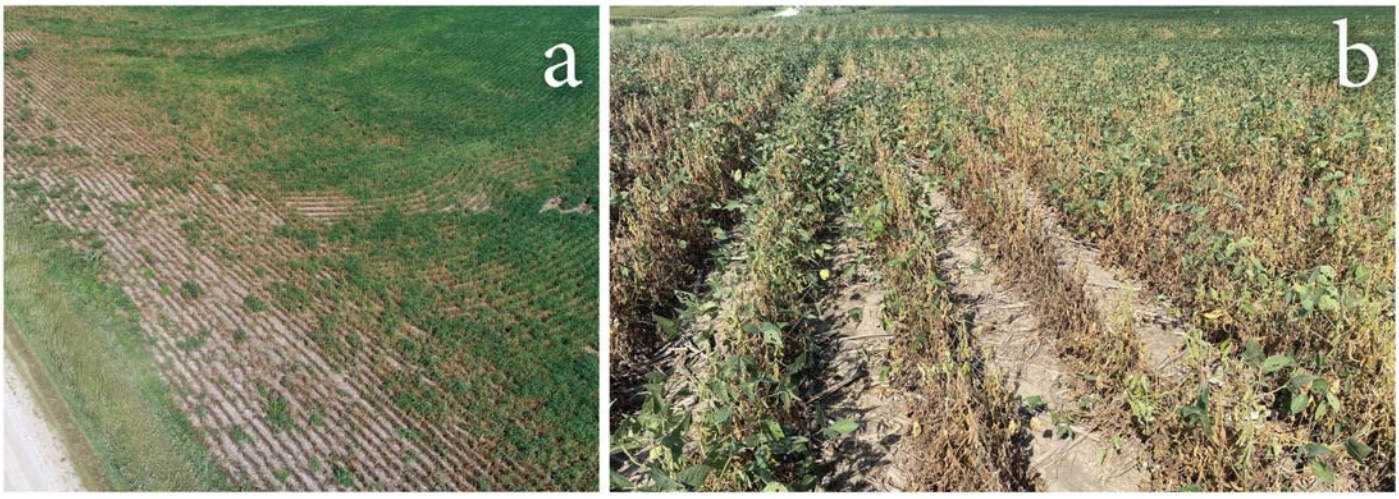

Figure 8. Aerial photo (a) (Credit: Nick Tinsley) and infield photo (b) of plant injury and death from soybean gall midge.

Figure 9. Sweet clover plant infested with soybean gall midge. Blackening or gray appearance are signs of infestation.

Management

Several strategies are being investigated for potential management of soybean gall midge. No tactic that has been tested provided complete control. Seed treatment, foliar, and in-furrow insecticide products have the potential to provide some suppression, but the effectiveness of these tactics will likely depend on multiple factors, such as the duration of adult emergence, date of planting, and environmental conditions.

REFERENCES CITED

Braker, N. 2020. White and yellow sweet clover (*Melilotus alba, M. officinalis)*. Carleton College Cowling Arboretum. https://apps.carleton.edu/campus/arb/about/species/invasives/sweet-clover/

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. *Proceedings of the Entomological Society of Washington*, 121(2), p. 168–177.

McMechan, A. J., E. Hodgson, A. J. Varenhorst, T. Hunt, R. Wright, and B. Potter. 2021. First report of a new species, *Resseliella maxima* (Diptera: Cecidomyiidae), causing injury to soybean in the United States. Journal of Integrated Pest Management. 12(1): 8, 1–4.

Pedersen, P., and M. Licht. 2014. Soybean growth and development. Iowa State University Extension and Outreach. PM 1945, 28 p.

This publication has been peer reviewed.
Nebraska Extension publications are available online at http://extension.unl.edu/publications.