



# WHEAT STEM SAWFLY BIOLOGY AND MANAGEMENT

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Figure 1A: Adult Wheat Stem Sawfly | Image credit: John Starinieri

## DESCRIPTION

- The wheat stem sawfly (WSS) is an ancestral wasp species, a stingless relative of bees, ants, and wasps, all belonging to the order Hymenoptera.
- WSS adults are 19mm long with smokey, opaque wings and yellow-and-black markings like their wasp cousins. (Figure 1A)
- WSS larvae are a cream-colored grub with a hardened brown head. Larvae are found exclusively within grass stems, eating their way down through the stem of the plant and leaving frass (excrement) behind them. (Figure 1B)

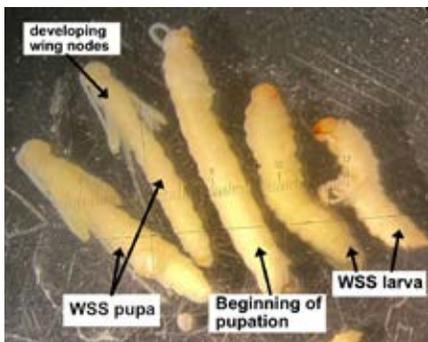


Figure 1B: Larvae/pupae WSS | Image credit: Erika Peirce

## INJURY

- WSS are pests of winter and spring wheat, triticale, and barley, and can also be found in native grasses.
- Injury to the plant becomes more noticeable when the larva reaches the bottom of the stalk and cuts a v-shaped notch into the plant, which weakens the stem and will likely cause it to fall over due to wind.
- Cut plants are hard to collect and often missed by harvesters. The inability to collect fallen heads from cut plants is the cause of most yield loss from WSS infestations.
- WSS can cause significant losses in yield, from around 15-40% of yield loss when untreated. The estimates of loss in Colorado are close to thirty million dollars.

## QUICK FACTS

- The wheat stem sawfly (WSS, *Cephus cinctus*) is an agricultural pest of cereal crops, primarily wheat, in the Great Plains from southern Alberta, Canada to Colorado, USA.
- The primary cause of damage to crops is the larva, which tunnels through the stalk of the plant and cuts it at the base, causing the plant to fall over.
- Current insecticides are ineffective against sawflies.
- Braconid parasitic wasps have potential to control the sawfly. However, they are currently not impactful in Colorado.
- Cultural controls such as tillage and trap crops can be beneficial in a pest control program for WSS.
- Solid and semi-solid stem wheat varieties are currently the most effective method available to resist damage and yield loss from WSS.



Figure 2: Wheat stems that have been cut by the sawfly larvae | Image credit: Erika Peirce

## RANGE AND LIFE HISTORY

- The WSS is found across the Great Plains and is found mostly in the northeastern corner of Colorado. (Figure 3)
- WSS has a single generation per year, with adult sawflies emerging in late May to early June for a flight period of 3-6 weeks. Male sawflies emerge first, followed shortly by females. Sawflies depend on warmer temperatures and will become active once temperatures consistently reach over 50° F.
- Females can lay 30-50 eggs in their lifetime, only laying one egg per stem. Multiple eggs are often laid in each stem, and upon hatching the larvae will eat each other until only one remains. The remaining larva will eat its way down to the base of the stem, growing to maturity. (Figure 5)
- Larvae overwinter in the stub of the plant after creating a “plug” out of frass to protect themselves. As temperatures warm, the larvae will pupate, developing into an adult which will soon emerge to begin the life cycle once more.

## MANAGEMENT

### SCOUTING

- To determine if the WSS is present, the easiest method is to look for adults during their flight period of late May through early June, while they are flying around the stems of grasses. (Figure 4)
- WSS infestations are typically most severe on the edges of fields that are adjacent to fields that grew wheat in the previous season. Female sawflies often prefer taller plants with wider stalks when laying their eggs.
- Once the eggs have been laid within the stems, the only way to determine if an infestation is present is to cut a stem from top to bottom and determine the presence of frass or larvae.
- Due to being cut by the larvae, many plants that have fallen over in the late season is a sure sign of the presence of WSS.

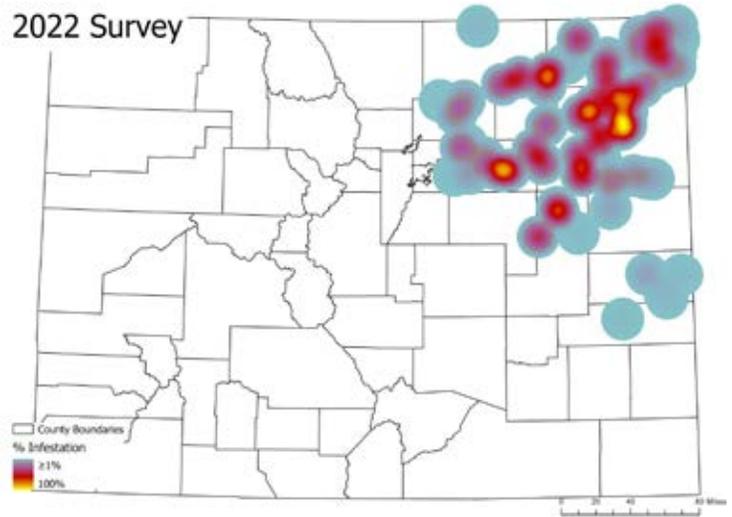


Figure 3: Range of WSS in Colorado, showing southward movement.

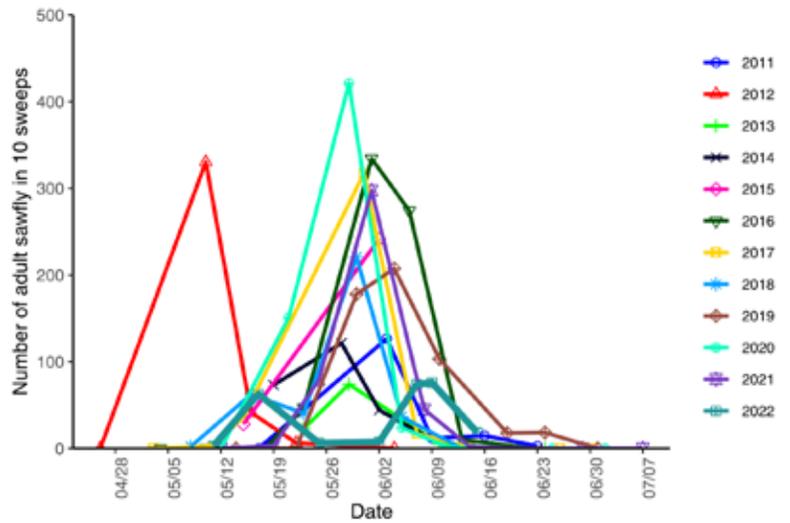


Figure 4: WSS survey results from 2011-2021

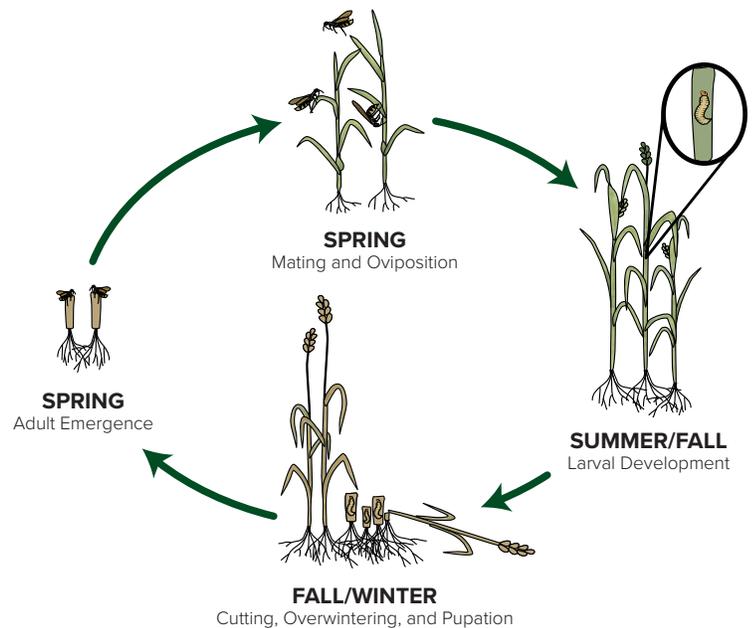


Figure 5: WSS life cycle | Image credit: Erika Peirce

## PESTICIDES

- Insecticides are broadly ineffective in controlling WSS. It is difficult to time sprays to line up with adult flights, and contact pesticides cannot reach the eggs and larvae inside wheat stems.

(Table 1)

## PARASITOID NATURAL ENEMIES

- *Bracon cephi* and *B. lissogaster* are two parasitoid wasps are known to attack WSS in spring and winter wheat. Both Bracon wasps are very small (15 mm) orange-brown insects.
- Parasitoid wasps lay their eggs on the larva of a sawfly, and the wasp larvae will eat the sawfly larvae from the inside.
- These wasps are more commonly effective for control of WSS in the northern states and only have small established populations in non-cultivated grasses in Colorado. The populations in Colorado have yet to be found parasitizing WSS in wheat.



**Figure 6:** A female Braconid wasp lays an egg inside a wheat stem | Image credit: Erika Peirce

**Table 1:** Insecticide Efficacies Against WSS

CHEMICAL	MODE OF ACTION	VARIATIONS	EFFICACY
Warrior II	Pyrethroid	4 spray timings, multiple applications, stubble spray	Ineffective
Palisade 2.1 EC	Plant Growth Regulator (PGR)	4 spray timings, multiple applications	Ineffective
Warrior II + Palisade 2.1EC	Pyrethroid + PGR	4 spray timings, multiple applications	Ineffective
Endigo ZCX	Pyrethroid + Neonicotinoid	4 spray timings, multiple applications	Potentially effective with precise application timing
Thimet 20C	Organophosphate	3 spray timings, multiple applications/rates	Ineffective
<i>Beauveria bassiana</i>	Fungi	Multiple rates	Ineffective

## CULTURAL CONTROLS

- Shallow tillage can expose larvae in wheat stubs to elements such as extreme temperatures and dehydration.
- Due to the WSS tendency to gather at the edges of fields, trap crops planted at the edges of fields can be used to protect wheat crops. Barley, oats, and triticale can be planted at edges of fields to attract female sawflies. Larvae cannot complete their development in oats.
- Trap crops will only work for mild infestations, as large infestations will spread past the edges of fields and into the wheat beyond the trap crops.

## SOLID STEM WHEAT VARIETIES

- The most effective method in WSS management currently available is the use of solid stem varieties of wheat. Solid stem varieties are bred to produce thicker stem walls that make it difficult for the adult sawfly to lay its eggs in the stem and more difficult for the larva to survive inside of the stem.
- Solid stem varieties have yield drag when compared to hollow stem varieties, but when under the pressure of sawfly infestation, solid stem varieties perform better than hollow stem.
- Colorado State University wheat breeders have developed two semi-solid varieties of wheat with reduced yield drag, Fortify SF and Amplify SF. Semi-solid varieties have the genes that give wheat the solid stem trait, without completely reducing the yield produced by the plant.

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