AGRI-FACTS
Practical Information for Alberta's Agriculture Industry

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Wheat Stem Sawfly

Wheat stem sawfly (*Cephus cinctus*) is native to North America and lives in grasses, mostly the wheatgrasses (*Agropyron*) and annual grass family crops.

Insect life cycle

Host plants

Cultivated hosts of the wheat stem sawfly include wheat, rye, triticale and some varieties of barley. Within the wheats, spring wheat is most heavily attacked in Alberta; winter wheat appears to have become a potential host in Alberta only within the last few years. In Montana, winter wheat has been severely infested and is arguably the major host there. Winter wheat is occasionally attacked in southern Alberta in counties bordering Montana.

Durum is often severely attacked by wheat stem sawfly. Oats and broad-leaved crops are immune. Female sawfly will lay eggs in barley, but the larvae seldom cause yield losses. Plant age is important to egg-laying females. Plants that have not reached the jointing (stem elongation) stage are not acceptable to females.

Wheat stem sawfly is best known as a pest of wheat

Summer and overwintering

The sawfly larva feeds within the stem and burrows down to or below ground level by the time the wheat heads begin to ripen. The larva then turns around, heads upwards and cuts most of the way through the stem at a point somewhere between soil level and about 2 cm above the ground, seals the end above itself, spins a cocoon in the stem and passes the winter as a larva in diapause (hibernation).

Spring appearance

Overwintering larvae pupate within their cocoons in May; adults begin to emerge in early summer from stubble fields and native grasses. As is common for many insects, males start to emerge first followed within a few days by females. In Alberta, sawfly adults appear from late June to early July. They are rather inactive insects that drift from plant to plant and spend most of their time resting on grass stems.

Number of generations

Wheat stem sawfly has one generation per year (univoltine).

Natural enemies

Parasites – There are nine known parasites of wheat stem sawfly; only one species, however, provides significant control. *Bracon cephi*, a native braconid wasp, is one of the few insect parasites that can move from grass to crops with the sawfly. When weather conditions delay crop maturation and sawfly larval development, *B. cephi*, by producing another generation, can increase its control of the wheat stem sawfly population.

Bracon lisogaster, a close relative of *B. cephi*, attacks sawfly larvae in the stems of grasses. It can significantly control wheat stem sawfly on native grasslands and roadsides. *Bracon lisogaster* is very rare in Alberta.

Damage assessment

Economic importance

The sawflies are all plant-eaters. Wheat stem sawfly is best known as a pest of wheat and has caused extensive losses to wheat in the northern Great Plains. Its history in Canada dates from 1895 when it first damaged wheat near Moose Jaw, Saskatchewan, and Souris, Manitoba. Wheat stem sawfly was slow to adapt to cereals but achieved pest status in the 1910s and 20s.

Changes in farming practices have affected the abundance of wheat stem sawfly. Tractor farming increased the relative abundance of wheat and decreased the

proportion of oats grown. In addition, as strip farming gained acceptance, sawflies spread easily from stubble and native grasses to wheat. As stubble farming of wheat on wheat stubble increased, so did wheat stem sawfly.

Heavy losses occurred primarily in the 1940s and 50s. In 1941, losses totalled 50 million bushels on the Canadian Prairies. Annual losses in Saskatchewan over the period 1926 to 1958 ranged from 1.4 per cent to 10.3 per cent of potential yield. The development of solid-stemmed wheat varieties greatly decreased the importance of this pest.

Damage description

The sawfly larva bores down inside the stem and makes a discolored tunnel from about the top joint to the root. The most diagnostic evidence of sawfly feeding is the presence of sawdust-like frass inside the wheat stem. The greatest losses occur around the margins of fields.

Wheat stem sawfly losses are of two types. Larvae feed within the stem of the plant and reduce both yield (a 5 to 15 per cent decrease in total seed weight) and quality of grain (from reduced protein and kernel weight). Larvae also cut stems and cause stems to break in the wind, fall to the ground and become unharvestable. These effects of feeding by larvae usually go unnoticed until the plants are toppled by wind and the weight of maturing heads. Mature larvae chew part way through and all around the inside of the stem just before cocoon formation in late summer.

Sampling and monitoring methods

Producers need to determine the percentage of plants infested by sawfly before harvest. This objective can be accomplished by cutting open the wheat plants and looking for the characteristic sawdust-like frass inside the stem.

Economic threshold

Solid stem wheat is recommended if 10 to 15 per cent of the crop in the previous year was cut by sawfly. Producers should swath wheat crops if more than 15 percent of stems are infested by sawflies.

Management strategy

Effects of weather

Most fluctuations in populations are caused indirectly by weather. The success of the natural enemy *Bracon cephi* is strongly favored by cool, wet August weather that delays the wheat harvest. With an extended harvest period *B. cephi* is able to fully complete a second generation. When the second generation is successful, a ten-fold increase in the level of parasitism occurs. Under drought conditions and earlier harvest, the second generation is largely wasted and fewer sawfly are attacked.

Sawfly population changes are largely due to the effectiveness of the natural enemies over a period of years. Wheat stem sawfly is a weak flier and will not take flight readily during cool, rainy or windy weather. Sunny, calm weather during the egg-laying period will promote dispersal of wheat stem sawfly.

Cultural practices

A number of practices reduce losses caused by this insect. More than any other practice, the use of resistant varieties has reduced sawfly damage.

Solid stem varieties – Tolerance to wheat stem sawfly is closely related to the stem solidness trait that has been bred into wheat varieties. Currently, three varieties are registered that have the solid stem trait: AC Lillian, AC Abbey and AC Eatonia. Research from Agriculture and Agri-Food Canada in Lethbridge has shown that solid stem wheat out-yields even the best hollow stem wheat when grown in sawfly-affected areas.

It is important to understand that solid stem wheat is tolerant to sawfly damage and not resistant. Some sawfly may still survive and cause cutting damage to solid stem varieties. Research at Lethbridge has also shown that female sawfly that emerge from solid stem wheat are smaller and lay fewer eggs than sawfly that emerge from hollow stem wheat. When solid stem wheat elongates in rainy, overcast conditions, the stems tend not to be as solid as when elongation takes place in bright, sunny conditions. When elongation occurs in the former situation, the level of control is affected, and increased cutting by sawfly can occur.

Crop rotation – To reduce sawfly populations, producers need to plant crops that are immune or resistant to wheat stem sawfly. Oats is immune to wheat stem sawfly. Sawfly do not survive in any broadleaf crops, and these crops are good options to consider when sawfly populations are high. Sawfly larvae can survive in barley, but usually do not thrive. Fewer acres in wheat mean fewer sawflies.

Trap crops – Plants that attract adults can be used to collect a sizeable portion of the population. The plants are then harvested, mowed or cultivated before the larvae move to the base of the plant (before mid-July).

Delayed seeding – Delayed seeding in spring produces a crop that is unattractive to females at egg-laying time, although this option is likely not a good idea due to yield and grade losses associated with late seeded wheat. Late maturing varieties help to allow the production of two generations of parasites, which results in fewer sawflies the following year.

Summerfallow and tillage – Producers can summerfallow infested stubble and then cultivate in early June in an attempt to kill the sawfly by drying them out as they pupate. However, more damage is done to beneficial insects than the sawfly, so the net benefit is usually negative. Tillage also increases the risk of soil erosion.

Burning – Burning infested stubble may reduce sawfly numbers, but it also greatly reduces parasite numbers and the benefits of returning stubble to the soil. In view of other cultural control options available and concerns about soil erosion, burning is not recommended.

Conservation tillage – Beneficial insects in the sawfly system are favored by a reduction in tillage. A study completed at Montana State University showed no appreciable increase in sawfly survival, but a much higher level of parasitism and a net reduction in infested wheat stems in reduced tillage systems as compared to conventional tillage systems.

Swathing – Producers should swath sawfly-infested wheat as soon as kernel moisture drops below 40 per cent to save infested stems before they fall.

Early harvest – Harvest early before sawfly damage occurs and preferably before larvae have moved below the cutting height. Cutting for forage or silage are options.

Block fields – Large block fields tend to suffer less sawfly damage than strip fields, especially in conditions of low to moderate populations.

Biological control

Parasitic insects are an important regulator of sawfly populations. Reductions in infestations have been attributed to heavy parasitism in the same or in the immediately preceding years.

Initially, sawflies in grain fields were apparently free of parasites; over time, the number of parasitized sawflies gradually increased. Different parasite species vary in their effects on sawfly populations, depending on whether the infested host plant is in a native or cultivated habitat. One parasite, *B. lisogaster*, prefers grasses over cereals.

Bracon cephi has become very effective in parasitizing sawfly in wheat fields. Recent research has shown that *Bracon cephi* is very effective in parasitizing sawfly that survive in solid stem wheat, making the biological control a valuable addition to the over control strategy.

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