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DIGGING INTO RESEARCH

Overwinter wheat stem sawfly mortality unaffected

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Wheat stem sawfly larval mortality did not occur between fall and spring sampling periods indicating that populations are not affected by abiotic or biotic factors during the winter. The populations of wheat stem sawfly and its natural enemies varied across fields in southern Alberta. The authors hope that these results will be incorporated into new forecasting models.

Wheat stem sawfly, *Cephus cinctus* Norton (Hymenoptera: Cephidae) causes crop losses by feeding within wheat stems, and indirectly through crop lodging because of weakened stems.

The wheat stem sawfly adult emerges from wheat stubble in the late spring. Females lay eggs into host plants, including wheat, during June and July. Once eggs hatch the larvae develop inside the wheat stem throughout the summer. Larval feeding results in reduced photosynthetic activity, decreased seed yield, and lower seed protein content. As wheat plants begin to mature, the larvae move to the base of the stem, and cut the stem to create a favourable environment to overwinter. In May, the larvae pupate within their cocoons, and the adult flies emerge.

Sowing of resistant solid-stem cultivars is a primary management tool. However, several natural enemies can contribute to management of wheat stem sawfly by helping to keep wheat stem sawfly populations under control.

Bracon cephi is the main natural enemy that attacks wheat stem sawfly during the summer months. It attacks wheat stem sawfly larvae in early summer before they cut wheat stems. The other parasitoid that has been reported in southern Alberta in small numbers is *Bracon lissogaster*. Parasitism rates have been reported as high as 90%.

The objective of this research study was to better understand the causes of wheat stem sawfly mortality across southern Alberta and between growing seasons.

The study ran from 2019 through 2021, and the fields surveyed had hollow stem wheat varieties. Six commercial wheat fields with known wheat stem sawfly damage were sampled after harvest in 2019. The total number of wheat stems was counted along 1 metre transects at 4 locations in each field, at locations 50 m apart. The wheat stems counted were separated into wheat stubs cut by wheat stem sawfly, and long stems that were cut during harvest and not impacted by wheat stem sawfly. At least 200 wheat stem stubs were collected from each field surveyed. The average number of cut stems was calculated for each field.

The collected stubs were assessed for the number of wheat stem sawfly cut stems, and the presence of wheat stem sawfly larvae in the cut stems including live and dead larvae. Probable death from parasitism and fungal pathogen or unknown causes were recorded. In April 2020, the same fields were resampled and assessed for the same data.

In the fall of 2020, another six fields were selected for the survey, and in the spring of 2021, the fields were resampled in April and May using the same protocol and for the same objectives.

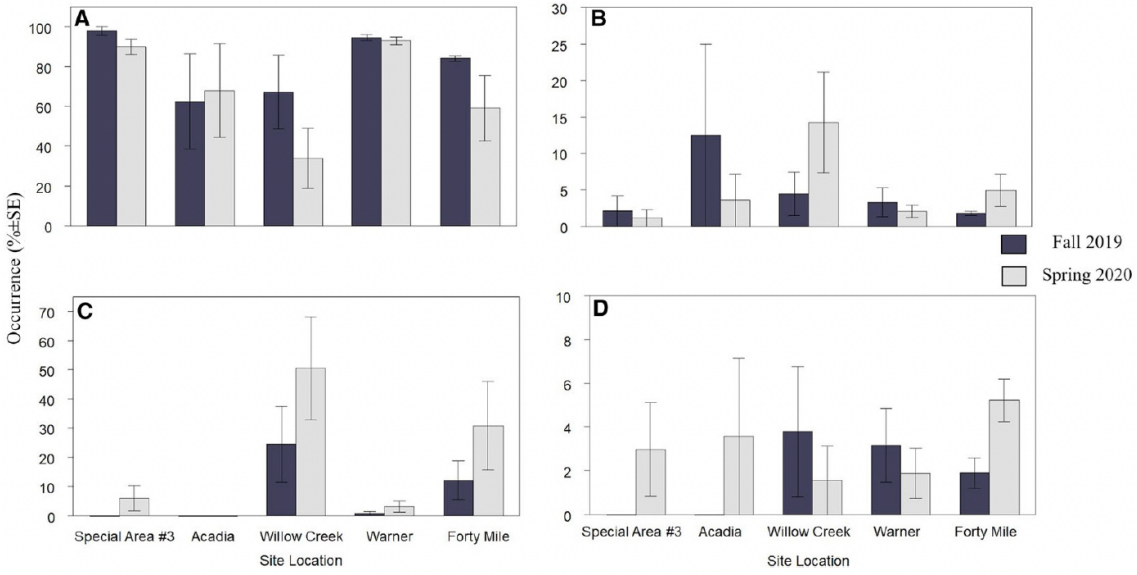
No overwinter mortality

In the first year of the study, 4237 wheat stems were analyzed with one field at Vulcan having minimal wheat stem sawfly damage and very few larvae present. The percentage of stems cut ranged from 5.4 to 68.6%, and the number that contained wheat stem sawfly larvae ranged from 3.3 to 66.2% in September 2019. Within each field, overwintering mortality did not differ. If parasitoids were present, overall larval mortality was most affected by the parasitoids. Mortality caused by pathogen infection ranged from 1.1 to 14.2% and mortality from unknown causes ranged from 1.6 to 5.2%.

The six fields sampled in September 2020 had 7342 stems sampled. Stem cutting and larvae were present in all fields, but the number varied widely between fields. Larval mortality did not differ between the two spring sampling periods at 4 of 5 sites. At the fifth field in the Special Area #3, mortality was lower in the fall of 2020 than in the two spring sampling periods.

In the second year of the study, fungus-associated mortality ranged from 0 to 27.6%, and unknown mortality ranged from 0 to 9%.

Occurrence of A, live *Cephus cinctus* larvae; B, fungal-associated larval mortality; C, parasitism-associated larval mortality; and D, unknown larval mortality from fall 2019 and spring 2020 larval mortality surveys.



Source: Sjolie et al. 2024

Overall, the study found that larval mortality in the majority of the fields was not affected between fall and spring. The proportion of larvae alive in the fall was roughly the same as that found in the post-overwintering phase. Mortality due to unknown factors such as malnutrition or disease, or abiotic stresses such as heat or cold stress was minimal at all sampling periods. These results indicate that winter weather is unlikely to impact wheat stem sawfly mortality. The study also found that wheat stem sawfly larval mortality varied greatly from field to field.

These two findings provide direction for wheat stem sawfly management. Scouting and surveying fields in the fall will provide a prediction of potential wheat stem sawfly infestations in the spring, especially if parasitism rates are factored into the predictions. Fall surveys to provide a wheat stem

sawfly forecast, along with individual field scouting by farmers and agronomists, can guide management decisions such as planting alternative crops on fields with high populations, or planting solid-stem wheat (or durum) varieties.

Although *B. cephi* and *B. lissogaster* larvae were found in wheat samples in the fall in the study, and are an important factor in larval mortality during the summer growing season, they are not expected to influence mortality between growing seasons. Including parasitism in predictive models could help increase the accuracy and utility of the models, however, doing so could be difficult because the influence of parasitoids on wheat stem sawfly populations varied quite significantly between the sampled fields. Therefore, incorporating parasitism into a phenology model could be difficult.

These results will help researchers develop phenology models and better forecasting systems for wheat stem sawfly on the Prairies. These results could also help improve integrated pest management plans for wheat stem sawfly

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Photo by Frank Peairs, Bugwood.org