Estimating *Cephus cinctus* Wheat Stem Cutting Damage – Can We Cut Stem Counts?¹

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**ABSTRACT**  In the last decade, the wheat stem sawfly (*Cephus cinctus* Norton (Hymenoptera: Cephidae)) has resurged as an important pest of wheat in the Canadian prairies and continues to be a chronic pest in the Northern Great Plains of the USA. Ecological and management studies to determine egg and larval infestation, damage and parasitoid attack rates, require laborious dissections of stems collected at various spatial scales. We used a statistical simulation study to determine the minimum number of stems required to estimate these response variables at the level of a sub-sample (e.g., within a plot). The number of stems required to estimate sawfly cutting damage and parasitoid attack to larvae was strongly and negatively related with the response variable. At moderate to high levels of sawfly pressure where the stems cut by larvae exceeds 40%, it is possible to reduce stem counts to 50 stems; however, in the 10% cutting range, up to 200 stems are needed for accurate estimates. These values were similar for sample size required to estimate larval parasitism but egg infestation of stems, when levels surpass 70%, can be determined with as few as 30 stems.

**KEY WORDS**  wheat stem sawfly, Monte Carlo simulation, sub-sampling, sawfly damage

*Cephus cinctus* is historically an important insect pest of wheat in the Canadian prairies and the Great Plains of the USA. Larvae develop and feed inside the lumen of thick-stemmed grasses and most cereal crops, destroying plant tissue and removing nutrients; upon maturation, larvae migrate to the base where they girdle the stem from the inside to plug the stem above their overwintering chamber (Criddle 1922). Most damaged stems break at this point and topple to the ground thereby causing additional harvest losses (Beres et al. 2007). Annual losses in the Canadian Prairies may surpass tens of millions of dollars during outbreak years.

Estimating damage risk for management purposes (e.g., http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/prm10584) or determining population parameters for ecological studies (Filipy et al. 1985) require sampling stems from experimental plots or at several points within commercial fields. Nansen et al. (2005a) determined within field spatial distribution of adult damage, immature populations (2005b) and number of sampling points needed to determine infestation

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