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Title: Development of a pheromone-based monitoring system for a newly identified *Contarinia* midge on the Canadian prairies

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Research Abstract

The canola flower midge *Contarinia brassicola* Sinclair (Diptera: Cecidomyiidae) is a newly-described species that induces galls on canola, *Brassica napus* Linnaeus (Brassicaceae) (Mori et al. 2019). The galls prevent flowers from opening and subsequent pod formation. The small size of *C. brassicola* and its morphological similarity to sympatric species of midge makes detection and identification difficult, such that damage to crops by *C. brassicola* is often overlooked. Many cecidomyiid midges of agricultural importance use sex pheromones (species-specific volatile chemical signals) to coordinate mate finding. Once properly identified, synthetic versions of these chemicals can be used as the basis of sensitive pheromone-based monitoring and management tools.

Here, we aimed to identify and synthesize the female-produced sex pheromone of *C. brassicola* and demonstrate its effectiveness in attracting males to traps in the field.

Using gas chromatography-electroantennography (GC-EAG) analysis of female-produced volatiles two chemical peaks were identified that elicited electrophysiological responses in male antennae. These peaks were initially characterized through gas chromatography-mass spectrometry (GC-MS) as 2,7-diacetoxynonane (major component) and 2-acetoxynonane (minor component), with the racemic compounds also eliciting EAG responses in male antennae. All four stereoisomers of 2,7-diacetoxynonane were synthesized and the naturally female-produced compound was shown to be primarily the *R,S*-isomer by analysis on an enantioselective GC column. The configuration of the minor component could not be determined because of the small amount present, but was assumed to be *R*. In field trapping trials conducted in Saskatchewan during 2018, the individual stereoisomers of 2,7-diacetoxynonane were unattractive to *C. brassicola* males. Re-examination of the analytical data suggested that a small amount of (*R,R*)-2,7-diacetoxynonane was also present in volatiles from female midges. During field trials in 2019, lures loaded with a 10 µg:1 µg blend of (*R,S*)- and (*R,R*)-2,7-diacetoxynonane caught large numbers of male *C. brassicola* and significantly more than other blends tested (Figure 1). Addition of 0.5 µg of (*R*)-2-acetoxynonane to this blend further increased the number of males caught.

Through this research, we identified the female-produced *C. brassicola* pheromone, and demonstrated that a lure containing 10:1:0.5 µg blend of (*R,S*)-2,7-diacetoxynonane, (*R,R*)-2,7-diacetoxynonane and (*R*)-2-acetoxynonane was highly attractive to males in the field. This identification will facilitate development of a pheromone-monitoring system for *C. brassicola*.

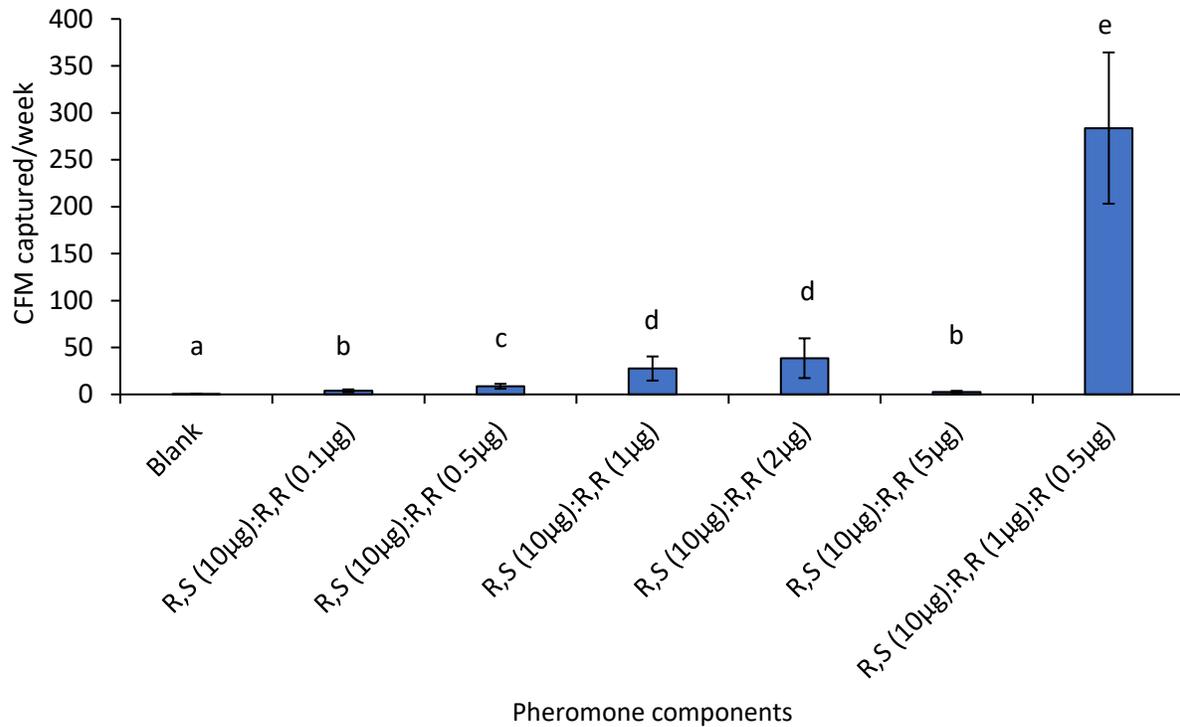


Figure: Mean (\pm SE) male *C. brassicola* (CFM) captured per week by traps baited with lures containing different amounts and isomers of the major (2,7,-diacetoxynonane) and minor ((2*R*)-acetoxynonane) pheromone components. Different letters above bars indicate significant differences (log-transformed data: GLMM $\chi^2 = 305.1$, d.f. = 6, $p < 0.00001$, followed by post-hoc test).

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References

Mori, B.A., L. Andreassen, J.D. Heal, J.R. Dupuis, J.J. Soroka, B.J. Sinclair. 2019. A new species of *Contarinia* Rondani (Diptera: Cecidomyiidae) that induces flower galls on canola (Brassicaceae) in the Canadian prairies. *The Canadian Entomologist* 151: 131-148.