Technologies have been developed to control the extensive feeding that occurs in Canola (Brassica napus) due to the crucifer flea beetle. Plant breeders and entomologists have developed ‘HAIRY CANOLA’ lines that have the potential, after further advancement, to significantly reduce crop input costs and provide consistent protection without the need for pesticide application and exposure.

Approximately $200M damage occurs annually to the Canadian canola crop from the crucifer flea beetle in spite of $40M in annual chemical application costs to control these pests. Crop losses due to drought in Canada range from $300M to $1B annually. In 2005, plant breeders and entomologists launched a three year research project to develop canola germplasm with protection against flea beetles and drought. This research on ‘HAIRY CANOLA’ and trichome regulatory genes is producing the world’s first germplasm with strong potential to develop into flea beetle resistant canola breeding germplasm. However, several more years of research is required in order to understand how to increase trichome coverage in Brassica napus without compromising growth.

In the initial phase of the project to advance ‘HAIRY CANOLA’ lines, researchers developed new progeny from crosses between canola transformed with maize anthocyanin regulatory genes and ‘HAIRY CANOLA’ lines transformed with the Arabidopsis GL3 and GL1 genes. These lines continue to show improvements in growth while maintaining the dense trichome coverage shown in the initial generations of ‘HAIRY CANOLA’. Plants with these traits are being evaluated and will help to determine the promoter regions that control dense trichome coverage and normal growth.

Advanced lines with dense seedling trichome coverage and improvements in growth compared with the original ‘HAIRY CANOLA’ lines are being developed. These new ‘very hairy’ F1 progeny have more robust green stems, dark purple coloration on the underside of the cotyledons, and larger phenotypes at the seedling stage than previously seen in less advanced lines. These results should enable plant breeders to design more effective strategies to express trichome genes in canola.
Researchers also evaluated flea beetle damage on ‘HAIRY CANOLA’ seedlings and the control *B. napus* cv. Westar seedlings in various laboratory bioassays. Laboratory insect choice and non-choice feeding bioassays and visual observances of flea beetle behaviour on ‘HAIRY CANOLA’ lines showed that flea beetles are still able to find small localized leaf areas bare of trichomes to feed upon, even though the trichome-enhanced lines are significantly less fed upon compared to the Westar control. In lab-choice feeding bioassays, the 48 hour rating consistently showed twice as many flea beetles on the Westar seedlings as compared to the ‘HAIRY CANOLA’ seedlings regardless of generation population or bioassay room temperature. The results of a 32°C bioassay showed extremely high feeding on all tissues of all seedlings except the stems of the ‘HAIRY CANOLA’.

In the second phase of the project, researchers screened for homozygous lines and improved the growth of these plants by crossing them with other lines that have normal growth and hairy stems. They also isolated an *Arabidopsis* trichome-branching gene and a newly discovered trichome-stimulating regulatory gene in an effort to increase the coverage of trichomes on the seedling plant surface of *Brassica napus* and to expand the affected tissues to include cotyledons. These experiments were initiated to cover some of the bare spots that tiny flea beetles could find and damage on the ‘HAIRY CANOLA’ lines. In total, 20 new *Arabidopsis* mutant lines with variation in trichome density and branching were recovered and are being evaluated to find novel genes that can increase trichome coverage, flea beetle resistance, and potentially, drought tolerance. Finally, research into factors that control trichome gene expression were conducted.

‘HAIRY CANOLA’ lines based on multi-gene traits that confound insect behaviour developed through this research have the potential after further advancement to significantly reduce crop input costs and provide consistent protection without the need for pesticide application and exposure. They may well be more tolerant to cold and wind desiccation due to the insulating effect of plant hairs. The technology will also be useful for Ethiopian mustard, which is being bred at SRC for biodiesel applications.
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