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Biotechnological strategies for effective control of the sugarbeet root maggot (*Tetanops myopaeformis* Roder).

Two approaches are being undertaken for management of the most devastating pest of sugarbeet in the US, the sugarbeet root maggot (SBRM). One approach involves the expression in transgenic sugarbeet plants of proteinase inhibitor genes which have specific activity against the root maggot's digestive proteases. These enzymes are essential for the release of nutrients for normal growth and development. Extracts of midguts excised from feeding second instar larvae were analyzed for specific protease classes using an inhibition assay. More than 86% of the gut protease activity was inhibited by 2 mM phenyl methyl sulfonyl fluoride, a serine protease inhibitor. Less than 3% inhibition was observed with 50 μM E-64, a cysteine protease inhibitor, and no inhibition with Pepstatin A, an aspartyl protease inhibitor. Using azocasein as a substrate, maximum protease activity was detected at pH 8.5, consistent with the serine class of proteases. Another approach being evaluated is the effect of cytokinin-induced insecticidal compounds on the SBRM larvae. A 1% suspension of leaf surface extracts from *Nicotiana plumbaginifolia* plants transformed with a cytokinin biosynthesis gene induced a twitching response and death of 30% of the first instar SBRM larvae at 72 hr. After 120 hr, 92% of the larvae were dead as compared to about 25% of the controls. Sugarbeet plants transformed with the cytokinin biosynthesis gene fused to a wound-inducible or a tuber-specific promoter have been regenerated for further analysis of the effect of cytokinins on defense responses.