COMPARATIVE ANALYSIS OF *BACILLUS THURINGIENSIS* TOXIN BINDING TO GYPSY MOTH, BROWNTAIL MOTH, AND DOUGLAS-FIR TUSSOCK MOTH MIDGUT TISSUE SECTIONS USING FLUORESCENCE MICROSCOPY

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ABSTRACT

Many strains of *Bacillus thuringiensis* (*Bt*) produce insecticidal proteins, also referred to as Cry toxins, in crystal inclusions during sporulation. When ingested by insects, the Cry toxins bind to receptors on the brush border midgut epithelial cells and create pores in the epithelial gut membranes resulting in the death of susceptible insects. Different *Bt* strains produce a wide variety of Cry toxins. The type of toxins present in the crystals determines the insecticidal potency and specificity of a particular strain.

Several derivatives of a *Bt* strain, HD1 *subsp. kurstaki* (*Btk*), have become the major biopesticide used to control forest pests such as the gypsy moth (*Lymantria dispar*) and the spruce budworm (*Choristoneura fumiferana*) in North America. *Bt* products can be as effective as conventional broad-spectrum insecticides with little or no effect on non-target organisms. However, control of some forest pests such as the Douglas-fir tussock moth, *Orgyia pseudotsugata*, and the browntail moth, *Euproctis crysorrhoea,* has not always been effective. These inconsistencies may in part be related to differences in the profile of the toxins present in different *Bt* formulations.

Because a critical step in the mode of action of *Bt* is the binding of Cry toxins to specific cell receptors, we examined, using fluorescence microscopy, Cry1Aa and Cry1Ac toxin binding and determined the presence of two *Bt* toxin receptors, BTR-270 and APN, in tissue sections of early fourth instar gypsy moth, Douglas-fir tussock moth, and browntail moth larvae. This experimental approach can be valuable for preliminary screening of *Bt* Cry proteins to discriminate between potentially lethal and nontoxic *Bt* Cry proteins. Although specific toxin binding of Cry proteins to midgut brush border membrane in target insect pests is indicative of toxicity, results of these experiments require confirmative testing.