Release, Persistence, and Effects of Larvicidal Proteins from Bacillus thuringiensis in Soil. (S03-stotzky120831-Oral)

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Abstract:

Larvicidal proteins produced by subspecies of Bacillus thuringiensis (Bt) and expressed in genetically engineered transgenic plants are released in root exudates throughout the growth of some plants (e.g., Cry1Ab protein from corn and rice and Cry3A protein from potato) but not of others (e.g., Cry1Ac protein from cotton, canola, and tobacco). The proteins in root exudates, as well as those released from biomass of all Bt plants or added in purified form, adsorbed and bound rapidly and tightly on surface-active particles (e.g., clays and humic acids) in soil, which significantly reduced the biodegradation of the proteins but not their larvicidal activity: e.g., purified protein persisted for 234 days, protein in root exudates persisted for 180 days, and protein in biomass persisted for three years, the longest times evaluated in soil in all cases. The biomass of Bt plants decomposed significantly slower than the biomass of isogenic non-Bt plants, both in soil and in the absence of soil but inoculated with a soil suspension. The slower decomposition of Bt corn may have been a result of the significantly higher content of lignin in Bt than in non-Bt corn. However, the content of lignin in the biomass of the other plants species, which was considerably lower than that of corn, was not significantly different between Bt and non-Bt plants. The vertical movement in soil of the protein, either purified, in root exudates, or from biomass of Bt corn, decreased as the amount of the clay minerals, kaolinite or montmorillonite, in the soil was increased. The protein was not taken up by non-Bt corn, carrot, radish, and turnip from soil in which Bt corn had been grown or into which purified protein or biomass of Bt corn had been incorporated. The proteins did not have any consistent statistically significant effects in soil on earthworms, nematodes, protozoa, culturable bacteria and fungi, and representative enzymes involved in the degradation of plant biomass or on bacteria, fungi, and algae in vitro.

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