

NATURAL ENEMIES AND RESISTANCE MANAGEMENT IN BT CORN: PARASITOID SEARCHING BEHAVIOR AND HOST SPATIAL DISTRIBUTION

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ABSTRACT. Introducing genetically modified insect-protected crops into the agricultural landscape has a profound effect on target herbivore abundance and distribution. Populations of specialized natural enemies are expected to be reduced because vast acreages of crops will no longer contain appropriate hosts. However, hosts should still be abundant in refuge plantings designed to prevent the spread of resistance in the target herbivore populations. The parasitoid's response to this heterogeneous host distribution can in turn influence resistance evolution in the herbivore. If the parasitoid shows a density-dependent response to herbivores, rare resistant herbivores in the transgenic crop will experience reduced parasitism pressure relative to their susceptible counterparts in the refuge. This may increase the relative fitness of resistant individuals, causing resistance to spread more quickly than in the absence of natural enemies.

We experimentally tested the density-dependent response of *Macrocentrus grandii* Goidanich, (Hymenoptera: Braconidae), a specialist parasitoid of the European corn borer, *Ostrinia nubilalis* Hübner (Lepidoptera: Crambidae). We created a matrix of different sized host patches within a field of Bt sweet corn by outplanting non-Bt plants and infesting them with *O. nubilalis* larvae. We then released *M. grandii* throughout the field and recorded larval parasitism. We found that *M. grandii* parasitism of *O. nubilalis* was approximately 50% lower in the smallest patch size relative to the larger patches, but that parasitism did not differ between medium and large patches. Moreover, parasitism of *O. nubilalis* in the smallest patches was correlated with distance of the small patch from larger patches: parasitism was greater in small patches near larger patches than in more remote small patches. These results indicate that isolated resistant *O. nubilalis* in transgenic Bt corn may enjoy reduced parasitism, thus promoting the relative fitness and spread of the resistant genotype. However, to minimize the effects of differential parasitism, tight spatial coupling of transgenic crops and refuges could be used to reduce the isolation of resistant hosts within the transgenic crop.