

## **Interactions of transgenic *Bacillus thuringiensis* insecticidal crops with spiders (Araneae)**

Genetically modified crops expressing insecticidal proteins from *Bacillus thuringiensis* (Bt) have dramatically increased in acreage since their introduction in the mid-1990's. Although the insecticidal mechanisms of Bt target specific pests, concerns persist regarding direct and indirect effects on non-target organisms. In the field, spiders may be exposed to Bt toxins via multiple routes, including phytophagy and pollenivory, consumption of Bt-containing prey, and soil exudates in the detrital food web. Beyond direct toxicity, Bt crops may also have indirect impacts, including pleiotropic and prey-mediated effects. Here, we comprehensively review the literature and use meta-analyses to reveal that foliar spider abundance is unaffected by Bt corn and eggplant, while cotton and rice revealed minor negative effects and there were positive effects from potato. Moreover, the soil-dwelling community of spiders was unaffected by Bt corn and cotton, while positively impacted in potato. However, Bt crops had higher populations of both foliar and epigeal spiders than insecticide-treated non-Bt crops. The current risk-assessment literature has several caveats that could limit interpretations of the data, including lack of taxonomic resolution and sampling methods that bias the results in favor of certain spiders. These families responded differently to Bt crops, and spider responses to insecticides are species- and toxin-specific, thus highlighting the need for greater taxonomic resolution. Bt crops have become a prominent, and increasingly dominant, part of the agricultural landscape; understanding their interactions with spiders, a diverse and integral component of agroecosystems, is therefore essential.