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Limitations to Use of Topical Toxicity Data for Predictions of Pesticide Side Effects in the Field

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Abstract

We consider ways in which laboratory-delivered toxicity data might be used to predict the safety of insecticides to beneficial invertebrates. A model test system consisting of a predator, the convergent lady beetle, *Hippodamia convergens* Guérin-Méneville (larvae and adults); a parasitoid, *Aphidius ervi* Haliday; and the bee species *Apis mellifera* L., *Megachile rotundata* (F.), and *Nomia melanderi* (Cockerell) was tested with diazinon, imidacloprid, and RH-7988 [ethyl (3-*tert*-butyl-1-dimethyl carbamoyl-1*H*-1,2,4-triazol-5-ylthio) acetate]. We also tested the pea aphid, *Acyrtosiphon pisum* (Harris), to calculate selectivity ratios for these beneficial species, which coexist with the

aphid pest in Washington State pea and alfalfa ecosystems. Topical toxicity was estimated for all species and ranged 0.0002–0.45 micro grams per insect for diazinon, 0.000031–0.04 micro grams per insect for imidacloprid, and 0.0015–6.11 micro grams per insect for RH-7988. Selectivity ratios based on these values spanned 0.02–47.4, 12.9–1,290.3, and 13.3–4,073 for diazinon, imidacloprid, and RH-7988, respectively. Risk assessment indices based on probit substitution (estimate of mortality of beneficial species at LD₉₀ for tile pest) and 2 standard methods for bees, a sequential testing scheme and a hazard index gave variable predictions of the compatibility of these compounds with integrated pest management. We conclude that predictive methods must advance to consider relative exposure rates to pesticides, aspects of chemical fate, and behavior of the organisms concerned if they are to be useful. Above all, predictions must be validated with field data.

Keywords: [risk assessment](#), [selective insecticides](#), [topical toxicity](#)

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