

## **In-hive medications may inhibit efflux transporters and endanger honey bees.**

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**Abstract:** Adverse reactions of honey bees (*Apis mellifera*) to combinations of pesticides and environmental toxins may contribute to seasonal hive depopulation or colony collapse disorder. We evaluated the role of the membrane-bound ABC transporter p-glycoprotein (p-gp) in protecting honey bees from two acaricides and the neonicotinoid insecticides imidacloprid, acetamiprid and thiacloprid. We demonstrate through inhibition by verapamil that p-gp protects honey bees from two widely used acaricides, coumaphos, an organophosphate, and fluvalinate, a pyrethroid. We also present evidence that neonicotinoid insecticides are substrates of p-gp and that inhibition of p-gp greatly synergizes their toxicity. The in-hive antibiotic oxytetracycline, previously known to inhibit p-gp driven efflux significantly sensitizes bees to the two acaricides. The co-application of tetracycline and the acaricides to bee hives could dangerously increase the risks of intoxication by the acaricides and other pesticides contaminating honeycomb and food stores.