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Avian exposure to fipronil, a new-generation pesticide: sensitivity, metabolic fate and species-specific variability

Malsha Kitulagodage¹², Lee B. Astheimer¹², William A. Buttemer¹³, Michael J. Hooper⁴, Andrew Keats⁵

¹Institute for Conservation Biology & Law, University of Wollongong, Wollongong, NSW, Australia
²School of Health Sciences, University of Wollongong, Wollongong, NSW, Australia
³School of Biological Sciences, University of Wollongong, Wollongong, NSW, Australia
⁴The Institute for Environmental and Human Health, Texas Tech University, Lubbock, Texas, USA
⁵Agri-Solutions Australia Pty Ltd, Brisbane, Qld, Australia

Fipronil, a phenyl pyrazole pesticide, is used in Australia to control locust outbreaks. Avian exposure to fipronil occurs via direct contact and by ingesting contaminated insects or seeds. Available avian toxicity information (8 species) shows high species-specific variability in fipronil sensitivity. This variability makes it extremely difficult to predict the toxicity of fipronil on unstudied species at high risk of exposure. We defined fipronil LD50 estimates (Up-and-Down protocol; OCED 2003) for two passeriformes: zebra finch and house finch, and also king quail, a galliforme (670 mg/kg, 310 mg/kg and 23 mg/kg respectively). During the course of this study we consequently discovered the solvent used in the fipronil-based formulation contributes significantly to the toxicity of the product. Sublethal effects of fipronil were also examined in bobwhite quail, another galliforme. Clear differences were observed in respect to the onset and duration of signs of fipronil intoxication between the two orders; signs were identical for both passeriformes with rapid onset and complete remission after 24 hours. For the galliformes definite signs were not observed until at least 2 days after treatment; birds did not eat or drink during this period. Metabolic fate analysis also indicates a difference between fipronil and fipronil-sulfone residue bioaccumulation between the two avian orders. Sulfone levels in tissue increased in the bobwhite quail over the first 3 days post treatment, in contrast to the significant drop in sulfone levels in passeriform tissue over this period. Considering that the sulfone is potentially more toxic than fipronil to vertebrates (Hainzl et al 1996), its possible that differences in the rate of conversion of fipronil to sulfone may account for the varied sensitivity to fipronil among species. Our results provide critically needed information for evaluating the ecotoxicology of fipronil as a result of locust-control spraying.