TOXICOLOGY CENTRE
990 SEMINAR SERIES

Erin Maloney

Toxicology Graduate Program

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"Neonicotinoid Insecticides: Characterizing Cumulative Toxicity of Binary Mixtures under Acute Exposure Scenarios"

Neonicotinoid insecticides are currently the most widely purchased and heavily used class of agrochemicals available world-wide. Commonly applied as seed-treatments or foliar sprays, these compounds are used to protect crops against a broad spectrum of biting-sucking insects. Neonicotinoids are highly water soluble, so following application these compounds (e.g., imidacloprid, clothianidin, and thiamethoxam) can move into nearby aquatic systems where they may display multi-season persistence in sediment, posing a risk to resident aquatic insect populations. Since application of different neonicotinoids often occurs within the same watershed, or between growing seasons, neonicotinoids are frequently detected in aquatic systems as binary and ternary mixtures. However, the cumulative toxicity of neonicotinoid mixtures is poorly characterized, therefore current regulations are based on single-compound toxicity values. This research aims to fill that knowledge gap by characterizing the cumulative toxicity of binary mixtures of commonly used neonicotinoids (imidacloprid (IMI), clothianidin (CLO), and thiamethoxam (TMX)) to larvae of the sensitive aquatic insect *Chironomus dilutus* under acute exposure scenarios. Single-compound toxicity was assessed in 96-hour laboratory tests, yielding toxicity threshold values (LC50) of 4.63 (3.96 – 5.41), 5.93 (5.29 – 6.65), and 55.34 (43.98 – 69.64) µg/L for IMI, CLO, and TMX respectively. These values were used to develop parametric models, which were statistically compared to the toxicity of binary mixtures from similar laboratory studies, using the MIXTOX modeling approach. CLO-TMX mixtures demonstrated concentration-additive synergistic toxicity. IMI-CLO mixtures demonstrated response-additive synergistic toxicity. IMI-TMX mixtures demonstrated response-additive dose-ratio dependent synergism, with toxicity shifting from antagonism to synergism as the relative concentration of TMX was increased. Results obtained indicate that under acute exposure scenarios, toxicity of binary neonicotinoid mixtures cannot be accurately predicted by direct addition of chemical concentrations, calling into question the protectiveness of current regulatory practises for aquatic ecosystems.

Monday, February 29th, 2016
12:30 pm
WCVM, Room 2115

All are welcome to attend

Coffee & Timbits will be served prior to the seminar.