Pollinator Research Task Force Industry Collaboration: Advancing the Science to Improve Pollinator Risk Assessments

Max Feken[1*], Ana Cabrera[2], Silvia Hinarejos[3], Daniel Schmehl[2]

*Max.Feken@syngenta.com [1]Syngenta Crop Protection, LLC, Greensboro, North Carolina, USA; [2]Bayer CropScience LP, Chesterfield, Missouri, USA; [3]Sumitomo Chemical, Saint Didier au Mont d'Or, France.

POLLINATOR RESEARCH TASK FORCE

ABSTRACT

Despite a wide breadth of pollinator focused scientific inquiry, research devoted to improving the fundamental aspects of pesticide risk assessment for pollinators is relatively sparse. To facilitate improvement in pollinator risk assessment knowledge, the Pollinator Research Task Force (PRTF) was formed in 2015 by a group of pesticide registrants, specifically focusing on the pollinator risk assessment paradigm jointly created in 2014 by the United States Environmental Protection Agency (US EPA), Health Canada Pest Management Regulatory Agency (PMRA) and the California Department of Pesticide Regulation. ***The research projects conducted by the PRTF are developed in collaboration with the US EPA ensuring relevancy to pollinator risk assessment needs in North America, while remaining cognizant of and generally applicable to regulatory issues regarding pollinators globally.*** This poster summarizes completed and ongoing PRTF projects.

COMPLETED PROJECTS

1. Validation and international ring-testing of an improved repeat dose larval toxicity test (OECD Guidance No. 239).
   - https://pollinatorresearchtaskforce.com/wp-content/uploads/2019/03/PRTF-Projects-Ring-Study-Report-Feb-2017.pdf
2. Guttation water as a source of exposure to pesticides: Literature review
   - *Schmolke A, Kearns B, and O'Neill B. 2018. Plant guttation water as a potential route for pesticide exposure in honey bees: a review of recent literature. Apidologie 49:637–646.*
3. Non-*Apis* bees exposure workshop (bumble bees, solitary bees, stingless bees)
   - https://academic.oup.com/ee/pages/pesticide_exposure_in_non-honey_bees for links to the six publications.
4. Comparison of acute toxicity of formulated products vs. active ingredients
   - *Spruill SE, O'Neill BF, Hinarejos S, Cabrera AR. 2020. A Comparison of Acute Toxicity Endpoints for Adult Honey Bees with Technical Grade Active Ingredients and Typical End-use Products as Test Substance, Journal of Economic Entomology 113 (2): 1015–1017, https://doi.org/10.1093/jee/toz305*
5. Literature review and analysis of honey bee colony-level consumption of pollen and nectar and of nectar consumption by nectar foragers
   - *Rodney S, Purdy J. 2020. Dietary requirements of individual nectar foragers, and colony-level pollen and nectar consumption: a review to support pesticide exposure assessment for honey bees. Apidologie 51:163–179. https://doi.org/10.1007/s13592-019-00694-9*
   - *Rodney S, Kramer, VJ. 2020. Probabilistic assessment of nectar requirements for nectar-foraging honey bees. Apidologie 51:180–200. https://doi.org/10.1007/s13592-019-00693-w*
6. Refinement, standardization and ring-test of the "Toxicity of Residues on Foliage: RT25 Test".
   - Submitted to US EPA (MRID* 51895501 and 51895502)
7. Re-evaluation of the Brigg's plant uptake model for predicting nectar and pollen residues for soil applied systemic pesticides
   - Submitted to US EPA (MRID* 52225801)

*MRID = Master Record Identification

Contribution from PRTF projects to BeeREX model inputs

Table 1. User inputs (related to exposure)

Description	Value
Application rate	1
Units of app rate	kg a.i./ha
Application method	foliar spray

Table 2. Toxicity data

Description	Value (µg a.i./bee)
Adult contact LD50	10
Adult oral LD50	28
Adult oral NOAEL	15
Larval LD50	100
Larval NOAEL	25

Table 3. Estimated concentrations in pollen and nectar

Application method	EECs (mg a.i./kg)	EECs (µg a.i./mg)
foliar spray	98	0.098
soil application	NA	NA
seed treatment	NA	NA
tree trunk	NA	NA

Table 4. Daily consumption of food, pesticide dose and resulting dietary RQs for all bees

Life stage	Caste or task in hive	Average age (in days)	Jelly (mg/day)	Nectar (mg/day)	Pollen (mg/day)	Total dose (µg a.i./bee)	Acute RQ	Chronic RQ
Adult	Worker (cell cleaning and capping)	0-10	0	60	6.65	6.5317	0.233275	0.435447
	Worker (brood and queen tending, nurse bees)	6 to 17	0	140	9.6	14.6608	0.5236	0.977387
	Worker (comb building, cleaning and food handling)	11 to 18	0	60	1.7	6.0466	0.21595	0.403107
	Worker (foraging for pollen)	>18	0	43.5	0.041	4.267018	0.1523935	0.284468
	Worker (foraging for nectar)	>18	0	292	0.041	28.620018	1.0221435	1.908001
	Worker (maintenance of hive in winter)	0-90	0	29	2	3.038	0.1085	0.202533
	Drone	>10	0	235	0.0002	23.0300196	0.8225007	1.535335
	Queen (laying 1500 eggs/day)	Entire lifestage	525	0	0	0.5145	0.018375	0.0343

- Validation of honey bee larval toxicity bioassay; more reliable test design
- Increase predictiveness of "residual toxicity of foliage" bioassay (<11 µg/bee)
- Default residue estimates in nectar and pollen following a foliar, seed treatment or soil application; based on actual pollen/nectar residues
- Refinement of nectar consumption estimate of an adult forager

ONGOING PROJECTS

1. Literature review of alternative exposure routes for non-*Apis* pollinators
   - Comprehensive literature review to gather new information/data relevant to quantification of pesticide exposure to non-*Apis* bees following the 2017 Workshop on "Pesticide Exposure Assessment Paradigm for non-*Apis* Bees".
2. Creation of a global nectar and pollen residue database for calculating residue per unit doses for different application methods (see ICPPR presentation).
   - EPA/PMRA Bee-REX model is based on a subset of the T-REX nomogram/RUD table, which is the peak residue (occurring immediately 1-d after application) for the long grass component.
   - Compilation of EFSA and EPA pollen & nectar residue databases
   - Creation of an interactive tool to calculate RUD values for different application types and timings
3. Relationship between consumption and bee weights in the OECD 245 (honey bee adult chronic toxicity) assay
   - EPA requires food consumption measurements to be collected in the 10-day adult chronic honey bee study. The food consumption is used to calculate the mean measured dose of a test item in the study, but EPA also considers this measurement relevant for sublethal effects including potential effects on growth.
   - Project Goal: Assess adult honey bee weight change during the 10-day adult chronic laboratory bioassay
4. Assessing potential for indirect effects to endangered plants from potential pesticide impacts to pollinators.
   - This project is focused on addressing the uncertainty associated with determining "indirect" effects of pesticides on listed plant species, primarily through direct effects on pollinator species which may impact their ability to provide pollination services to endangered plants.
   - Compile information on traits of endangered plants in the category of "unknown other aspects of reproduction strategy".

COMPLETED PROJECTS (cont.)

8. Evaluation of the BEEHAVE model parameterized to North American conditions for prediction of over-wintering survival in colony feeding studies.
   - *Schmolke A, Abi-Akar F, Roy C, Galic N, Hinarejos S. 2020. Simulating Honey Bee Large-Scale Colony Feeding Studies Using the BEEHAVE Model—Part I: Model Validation. Environ Toxicol Chem 39:2269–2285.*
   - *Abi-Akar F, Schmolke A, Roy C, Galic N, Hinarejos S. 2020. Simulating Honey Bee Large-Scale Colony Feeding Studies Using the BEEHAVE Model—Part II: Analysis of Overwintering Outcomes. Environ Toxicol Chem, 39:2286–2297. https://doi.org/10.1002/etc.4844*
9. Laboratory evaluation of alternative solvents for use in honey bee adult and larval tests.
   - *Tomé H, Clark S, Jorgenson B, Kimmel S, Wenzel B, Gimeno C, Porch J, Patnaude M, Schmidt K, Deslandes L, Schmehl, D. 2023. Chronic larval and adult honey bee laboratory testing: Which dietary additive should be considered when a test substance is not solubilized in acetone?, Ecotoxicology and Environmental Safety, Volume 268. https://doi.org/10.1016/j.ecoenv.2023.115718.*
10. Applicability of current honey bee larval toxicity protocols and endpoints (acute and chronic) for use in pollinator risk assessments
    - *De Souza DA, Feken M, Tomé HVV, Schmehl DR. 2024. Honey bee larval toxicity study designs: Applicability of the current study protocols and endpoints as a predictor of pesticide hazard for pollinators. Integr Environ Assess Manag. https://doi.org/10.1002/ieam.4982.*

PRTF member companies