

2018 Understanding Pesticide Toxicity to Pollinators

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Pesticide Toxicity to Pollinators

The active and inert ingredient can be found on the label on the pesticide container. The active ingredient is the chemical registered by the EPA as causing the toxicity of the product to the pest or beneficial insect. Recent papers demonstrate that inert ingredients are highly toxicity to bees as well. Inert ingredients are penetrating agents, odor maskers, stabilizers, preservatives, diluents, surfactants, emulsifiers, propellants, solvents, spreaders, stickers, antifoaming agents, dyes, and drift retardants that modify the physicochemical properties of the spray mixture. Some recent papers demonstrate that the inert ingredient called "organosilicone surfactant adjuvants" increase virus transmission in bees. Also, in recent studies fungicides demonstrated toxicity to bees. Another major issue is that the EPA registers the active ingredient and determines toxicity of the chemical based on short term, 4 day, LD 50 tests (lethal dose to 50% of the population) and not chronic, long term exposure. However, numerous papers are demonstrating that lower, sub-lethal amounts of pesticides affect behavior and alter the ability of insects to find food and survive. For these and numerous other reasons most insecticides are not safe to use around bees and other beneficial insects, such as lady beetles.

IPM: Systemic Compared to Contact Insecticides

The conservation of beneficial insects, that includes bees, insect predators, parasitic wasps, and butterflies, is an essential part of Integrated Pest Management (IPM) programs. IPM promotes multiple tactics to manage pests and to suppress the population size below levels that will damage the plant. Beneficial insects can only manage small, pest populations, when populations of pests are high, conventional insecticides must be used. For most pests that eat leaves, use contact insecticides that sit on the leaf surface and do not move into the plant and the toxicity to pests last for a few days on the foliage. Flowers that open after being sprayed with contact insecticides do not contain insecticide residue. Systemic insecticides move from the leaves or soil into OTHER plant parts as nectar and pollen. Flowers that open after systemic insecticides are sprayed can absorb the insecticide and the residue in leaves and flowers can last for many months.

Systemic, neonicotinoid insecticides are widely used, due to their low mammalian toxicity and the ability of the insecticide to move systemically from soil into the entire plant. However, they often move into pollen and nectar and when fed on by bees alter bee behavior or increase bee mortality. Application methods include seed treatments, foliar sprays, soil and trunk drenches, and trunk-injections. There are six systemic neonicotinoid active ingredients, imidacloprid, dinotefuran, thiamethoxam, clothianidin, acetamiprid and thiacloprid. You will find these active ingredients listed on the insecticide label in small print. Neonicotinoid insecticides are very toxic to bees and beneficial insects, especially as residue in pollen and nectar.

Manage with IPM by using cultural control, sanitation, biological control, using insecticides friendly to beneficial insects (low toxicity in the table). Remember "organic MRI approved insecticides" can be very toxic.

1. Scout for populations of both pest and beneficial insects, such as lady beetles and bees. Determine if the good bugs are suppressing the pest bugs and no loss to flowering or food production can be found.
2. If beneficial insects are present and the pest population is increasing, then spray CONTACT insecticides on the foliage. Contact insecticides are degraded in a few days by light, water, and microbes.
3. Do not apply insecticides to flowers.
4. Spray contact insecticides on leaves in the evening when bees and lady beetles are not foraging.
5. Use insecticides that are less toxic to bees, such as oils, soaps, neem oil, Acelepryn (chlorantraniliprole), miticides, and insect growth regulators

Toxicity to Pollinators of Insecticides Used in Greenhouse, Nursery, and Landscapes. Bolded are insecticides not permitted by the MDA on bee-friendly-labeled plants. Highlighted in gray are less toxic AI.

Chemical class/MOA	Common name/MOA will be found on consumer products	Examples of trade names for professionals	LD 50*	Toxicity to honeybees**		
				ug/bee	Non	Mod Toxic
Carbamates/1A	carbaryl methomyl	Sevin, Lannate	0.014 0.816			x x
Neonicotinoids/4	imidacloprid thiamethoxam clothianidin dinotefuran imid+bifenthrin imid+cyfluthrin ag: imidacloprid ag: clothianidin ag: thiamethoxam flypyradifurone sulfoxaflor +spinetoram	Merit, Marathon Flagship, Meridian Arena, Aloft Safari Allectus Discus Gaucho, Admire Poncho, Venom, Cruiser, Platinum <i>Altus,</i> <i>XXpire cancelled</i>	0.004 0.004 0.005 0.023 0.004 0.004 1.2 0.0208 0.14			x x x x x x x x x
	less toxic: acetamiprid thiacloprid	Tristar, Assail Calypso	14.5 27.8	x x		
Organophosphates/1B	acephate chlorpyrifos dimethoate malathion phosmet	Orthene Dursban/Lorsban Dimethoate Malathion Imidan	0.1082 0.06 0.038 0.16 0.1			x x x x x
Pyrethroids/3A	bifenthrin cyfluthrin fenpropathrin lambda-cyhalothrin permethrin resmethrin	Attain/Talstar Tempo, Decathalon Tame Scimitar Astro, Pounce foggers	0.1 0.001 0.05 0.038 0.029 0.065			x x x x x x
Botanical/3	pyrethrin	Pyganic	0.15			x
Insect growth regulators	diflubenzuron/15 tebufenozide/18	Adept, Dimilin Confirm	25 234	x x		
	azadirachtin/UN Neem oil buprofezin/16 pyriproxyfen/7C	Aza-Direct, Azatin Talus Distance, <i>Fulcrom</i>	2.5 163 100	x x	x	
	novaluron/15	Pedestal	150	x		
	cyromazine/17	Citation	25	x		
	Juvenile hormone /7A	s-kinoprene	Enstar II	35	x	
Anthranilic Diamides/28	chlordantraniliprole	Acelepryn	>104	x		
	cyantraniliprole	<i>Mainspring</i>	0.116			x
Macrocytic lactones/6	abamectin emamectin-benzoate	Avid, Sirocco Tree-age, Enfold	0.009 0.41			x x
Miticides	acequinocyl/20B etoxazole/10B fenpyroximate/21A	Shuttle TetraSan, Beethoven Akari, Vendex	>100 200 162	x x x		

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				ug/bee	Non	Mod Toxic
	fenbutatin-oxide/12B halofenozide/18	Mach II	3982 100	x x		
	clofentezine/10A hexythiazox /10A	Ovation Hexygon	111 200	x x		
	bifenazate/20D	Floramite	7.8		x	
	bifenazate/20D+ abemectin/6	Sirocco	0.009 7.8			x
	pyridaben/21A	Sanmite	0.024			x
	chlorfenapyr/13	Pylon	0.12			x
	cyflumetofen/25A	<i>Sultan</i>	102	x		
Spinosyns/5	spinosad spinetoram	Conserve/Entrust less toxic dried <i>Radiant</i>	0.05 0.14			x x
Tetronic acids/23	spirotetramat spiromesifen	Kontos Judo, Forbid	107 200	x x		
GABA-channel	fipronil/2B	Fipronil, Termidor	0.004			x
Pyridine carboxamide	flonicamid/29	Aria	60.5	x		
Pyridine azomethines/9B	pymetrozine pyrifluquinazon	Endeavor <i>Rycar</i>	158.5	x x		
	pyridalyl/UN	<i>Overture</i>	6.16		x	
	<i>Bacillus thuringiensis/11A</i> Or other <i>Bacillus</i> sp	Bt/Dipel		x		
	<i>Chromobacterium/11A</i>	<i>Granevo</i>		x		
	<i>Isaria</i> fungus	<i>Preferal</i>				
	potassium salts fatty acids soaps	Surround, M-Pede		x		
	horticultural mineral oils	Monterey Oil			x	

The information given herein is supplied with the understanding that no discrimination is intended and no endorsement by University of Minnesota Extension. Remember, the label is law.

- **Toxicity Category I, highly toxic to bees, Acute Contact LD₅₀ is < 2 µg/bee
 Toxicity Category II, moderately toxic to bees, the LD₅₀ is 2-10.99 µg/bee
 Toxicity Category III, Relatively nontoxic, NT, to bees, the LD₅₀ is 11-100 µg/bee
1. [Protecting honeybees from pesticides, Purdue Extension](#), E-53W, Krupke, C., G. Hunt, and R. Foster, June 2014
 2. [How to reduce bee poisoning from pesticides](#), A Pacific Northwest Extension Publication, OSU, UI, WSU, PNW 591, Hooven, L., Sagili, and E. Johansen; Pesticide toxicity to bees
 3. [Pesticide stewardship](#)
 4. [Farmland birds, list of EPA 2011 pesticides and LD50](#)
 5. [University of PPDB Hertfordshire, pesticide properties database](#)
 6. [Pesticide Target Interaction Base](#)
 7. [Safety and use of neonicotinoids insecticides in turfgrass](#), Doug Richmond, Purdue University

Herbicide Toxicity to Pollinators

Most active ingredients in herbicides are not toxic to bees. Again, the inert ingredients are shown in studies to have toxicity to bees. This is a new field of research and all the data is not yet generated to understand this emerging issue.

Toxicity to Pollinators of Herbicides			
Trade name/ AI	Active ingredient (AI)/MOA	Toxicity to bees: LD₅₀ contact	Toxicity to bees: LD₅₀ oral
Progeny	MCPA, triclopyr, +dicamba/1	nontoxic to bees	na
Stalker	imazapyr/3	nontoxic to bees	na
Streamiline, Imprellis	aminocyclopyrachlor/1	nontoxic to bees	na
Roundup	glyphosate/1, 2	nontoxic to bees	Low levels alter navigation bees (1)
Garlon	triclopyr/1	nontoxic to bees	nontoxic to bees
Banvel, Diablo, Oracle, Vanquish	dicamba/1	nontoxic to bees	3.6 µg/bee, moderately toxic
Chiptox, Weed-B-Gone, Verdoe, Weed'N'Feed	MCPA/1	nontoxic to bees	
Roundup GroundClear	imazapyr/3	nontoxic to bees	na
Imprellis	aminocyclopyrachlor/1	nontoxic to bees	na
Comparison to imidacloprid/insecticide		0.0004 µg/bee, highly toxic	0.0004 µg/bee, highly toxic
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<p>**Toxicity Category I, highly toxic to bees, Acute Contact LD50 is < 2 µg/bee Toxicity Category II, moderately toxic to bees, the LD50 is 2-10.99 µg/bee Toxicity Category III, Relatively nontoxic, NT, to bees, the LD50 is 11-100 µg/bee (1). Balbuena, M.S., L Tiosn et al. 2015.. Effects of sublethal doses of glyphosate on honeybee navigation. http://www.boerenlandvogels.nl/sites/default/files/Effects%20of%20Glyphosate%20on%20Honey%20Bee%20Navigation.pdf /1, 2,4-D, dicamba, triclopyr, MCPA, aminocyclopyrachlor /auxin growth regulators /2, glyphosate/ amino acid inhibitor /3, imazapyr/amino acid inhibitor</p>			