Pesticides and Pollinators

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The Most Common Causes of Pollinator Poisonings

Source: *How To Reduce Bee Poisoning From Pesticides* Authors: Louisa Hooven, Ramesh Sagili and Erik Johansen. A Pacific Northwest Extension Publication, PNW 591 (Just Google it and it will come up) or, go to https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/pnw591.pdf

Most bee poisoning incidents occur when:

1. Insecticides are applied when bees are foraging
2. Insecticides are applied to bee-pollinated crops during bloom
3. Insecticides are applied to blooming weeds in orchards or field margins
4. Insecticides drift onto blooming plants adjacent to the target crop
5. Bees collect insecticide-contaminated pollen (such as corn), nectar (such as cotton or mint), or other materials from treated crops that do not require bee pollination
6. Bees collect insecticide-contaminated nectar from plants treated with systemic pesticides
7. Bees collect insecticide-contaminated nesting materials, such as leaf pieces collected by alfalfa leafcutting bees
8. Bees collect insecticide-contaminated water (from drip tape or chemigation, for example)
9. Beekeepers and growers do not adequately communicate

Even if the insecticide isn't strong enough that pollinators aren't killed immediately, they get sick. They can have impaired reproduction, lowered immune systems, can't forage or navigate as well, and this all makes them more susceptible to bacteria, viruses, mites, and creatures that eat insects. More recent research also shows that the bees don't clean their hives as frequently, which also makes them more susceptible to other diseases.

Pesticides Associated With Bee Declines

1. Neonicotinoids. These is a very popular class of insecticides, and one in this class was the one which killed the 50,000 bumblebees in Oregon. Examples in this class include Imadacloprid, the most widely used insecticide in the world.

2. Organophosphates such as acephate, azinphosmethyl, chlorpyrifos, diazinon, dimethoate, malathion, and methamidophos

3. Carbamates, such as carbaryl

4. Synthetic Pyrethroids. The toxic effects are paralysis and death. The sublethal effects include impaired ability to learn, forage, and reproduce. There are many types of synthetic pyrethroids on the market. You will know it is a synthetic pyrethroid because the chemical names for them end in 'thrin'.

Pyrethroids	Birds (mg pyrethroids/kgbody weight)	Fish	Bees
Allethrin	2030	Toxic	-
s-Bioallethrin (Esbiol)	680	Highly toxic	-
Resmethrin	-	Toxic	Highly toxic
Bioresmethrin	-	Highly toxic	Highly toxic
Tetramethrin	>1000	Toxic	Toxic
Permethrin	>13500	Highly toxic	Highly toxic
Fenvalerate	9932	Highly toxic	-
d-Phenothrin	>2500	Toxic	Toxic
Cypermethrin	-	Extremely toxic	Toxic
Esfenvalerate	-	Highly toxic	-
Bifenthrin	>2150	Toxic	-
Fenpropathrin	1089	Toxic	-
Refluthrin	4190	Highly toxic	-
Cyfluthrin	4450	Toxic	Toxic
Fluvalinate	>5620	Toxic	Non-toxic
Tralomethrin	7716	Extremely toxic	Highly toxic
Deltamethrin	>4640	Toxic	Highly toxic
Cyhalothrin	>5000	Highly toxic	-
Kadethrin	-	Toxic	Toxic
Alphacypermethrin	-	Toxic	Toxic
Lambda-cyhalothrin	>3950	Toxic	Toxic

Source: Thatheyus, A.J., and A.Deborah Gnana Selvam. "Synthetic Pyrethroids: Toxicity and Biodegradation." Applied Ecology and Environmental Sciences 1.3 (2013): 33-36

Signs and Symptoms of Bee Poisoning

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Honey bees

1. Excessive numbers of dead and dying honey bees in front of the hives
2. Increased defensiveness (most insecticides)
3. Lack of foraging bees on a normally attractive blooming crop (most insecticides)
4. Stupefaction, paralysis, and abnormally jerky, wobbly, or rapid movements; spinning on the back (organophosphates, organochlorines, and neonicotinoids)
5. Forager disorientation and reduced foraging efficiency (neonicotinoids)
6. Immobile, lethargic bees unable to leave flowers (many insecticides)
7. Regurgitation of honey stomach contents and tongue extension (organophosphates and pyrethroids)
8. Performance of abnormal communication dances, fighting, or confusion at the hive entrance (organophosphates)
9. The appearance of “crawlers” (bees unable to fly). Bees move slowly as though they have been chilled (carbaryl).
10. Dead brood; dead, newly emerged workers; or abnormal queen behavior, such as egg laying in a poor pattern (carbaryl)
11. Queenless hives (acephate, carbaryl, malathion, methamidophos)
12. Poor queen development in colonies used to produce queens, with adult worker bees unaffected (coumaphos)

Alternatives to The Most Toxic Pesticides

If a pest problem develops, first be sure you have the problem accurately diagnosed. The Master Gardeners can help you with that. Only then decide if you even need to take action, or if some damage is acceptable while nature takes its course. If you decide to take action, use the least toxic solution. Physical controls like traps, barriers, fabric row covers, or repellants may work. Less toxic products like soaps, horticultural oils, and plant-based insecticides are now available. Go to www.GrowSmartGrowSafe.org for recommendations.
Beneficial insects are available for sale, or you can attract these "good bugs" by planting a variety of plants that provide pollen and nectar all year.

The Xerces Society has excellent resources: http://xerces.org/pesticides/
Here is a chart they developed:

PESTICIDE	NON-TOXIC	LOW TOXICITY	HIGHLY TOXIC
Insecticides/Repellants/Pest Barriers			
Bacillus thuringiensis (Bt)			
Beauveria bassiana			
Boric Acid			
Cydia pomonella granulosis			
Diatomaceous Earth			
Garlic			
Insecticidal Soap [a]			
Kaolin Clay			
Limonene [a]			
Neem [a]			
Horticultural Oil [a,b]			
Pyrethrins [c]			
Rotenone [c]			
Ryania/Ryanodine			
Sabadilla [c]			
Spinosad			
Herbicides/Plant Growth Regulators/Adjuvants			
Adjuvants			
Corn Gluten			
Gibberellic Acid			
Horticultural Vinegar			
Fungicides/Bactericides			
Copper			
Copper Sulfate			
Lime Sulfur [a], Sulfur [c,d]			

[a] Low risk to bees if applied at night when bees are inactive
[b] Some horticultural oils (such as formulations with thyme or rosemary oil) primarily sold as fungicides.
[c] Repellent >1day. In greenhouse setting, bees should be removed prior to spray and not replaced before 1.5 days after spray.
[d] Long residual toxicity (1-7 days).

Additional Details of pest-management practices can be found in the Pacific Northwest pest management handbooks at www.ipmnet.org/, Washington State University IPM website, www.ipm.wsu.edu/, University of Idaho IPM Center, www.extension.uidaho.edu/ipm/, and the University of California Statewide IPM Program at www.ipm.ucdavis.edu/.

Protecting Wild Native Bees from Pesticide Poisoning

Where sufficient habitat is available, wild native bee species often provide all of the pollination services needed for high crop yields and fruit quality. Depending on the species, native bees may nest in underground tunnels, hollow plant stems, and tunnels in wood. Bumble bee colonies favor small cavities under lodged grass, in abandoned rodent burrows, in trees, or old bird nests. These unmanaged pollinators are an on-site natural resource, and unlike honey bees, cannot be moved from the field when pesticides are used. In fact, many ground-nesting species, such as squash bees, long-horned bees, mining bees, and sweat bees, construct their nests in the midst of annual and perennial crop fields.

To protect these bees, ensure that drifting pesticides never contact adjacent habitat, even when crops or wildflowers are not in bloom. Scout crop fields, and protect ground nests of solitary bees and bumble bees from insecticide spray. Visit the Xerces Society webpage to learn more about conserving a variety of insect pollinators: www.xerces.org/.

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Other Resources

1. **Garden Green**: http://gardengreen.webs.com/
2. **Grow Smart, Grow Safe**: https://www.growsmartgrowsafe.org/Products?pesticideTypeId=14
3. **Beyond Pesticides**: https://www.beyondpesticides.org/programs/bee-protective-pollinators-and-pesticides/bee-protective
4. **Thurston County scientists** provide an analysis of active ingredients and their danger to bees: http://www.co.thurston.wa.us/health/ehipm/insctrodntslug.html
5. **Book: The Bees in Your Backyard**: A Guide to North America's Bees by Joseph S. Wilson
6. **Organic-Approved Pesticides**: Minimizing Risks to Bees, the Xerces Society
7. **New Hampshire Pollinator Summit** 2015, Gary Fish, Maine Board of Pesticides Control http://www.maine.gov/dacf/php/pesticides/documents2/pollinators/NHPollinatorSummit_GaryFish.pdf
8. **Attracting Pollinators to Your Garden Using Native Plants**: US Department of Agriculture https://www.fs.fed.us/wildflowers/pollinators/documents/AttractingPollinatorsV5.pdf
9. **Non-Bee Insect Pollinators**: Flies, Wasps, Beetles, Butterflies http://www.pnas.org/content/113/1/146.short
10. **Pacific Northwest Bees**: https://www.arboretumfoundation.org/about-us/publications/bulletin/bulletin-archive/pacific-northwest-bees/