



The Good, the Bad, and the Bugly: Biological Control, Integrated Pest Management, and Knowing Who Your Friends Are

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The IPM Pyramid – ‘first do no harm’

Start here (green arrow pointing to Biological Control)

Other Tools
Cultural controls (eg crop rotation, reseeding); Mechanical controls (eg, mowing, fencing); Plant selection.

Biological Control
Use of natural enemies such as parasites, predators, naturally occurring pathogens to reduce populations of pests.

Pesticides (Last resort)

- Use the least invasive - and often most effective - means first:
 - Prevention - cultural practices
 - Mechanical Controls
 - Naturally occurring biological controls (native predators)
- Consider using non-native predators
- Use chemical controls sparingly, as a last resort:
 - Naturally occurring elements
 - Biologics - chemicals made by plants that are toxic to pests/diseases
 - Non-biologic pesticides:
 - Insecticides
 - Fungicides
 - Miticides

Non-native predators and chemical controls have the important drawback of non-specificity – they kill the good pests with the bad.

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Relative toxicity of insecticides to Friends of the Garden

Insecticide	Toxicity to Friendly Parasites and Predators ¹	
	Direct	Residual
microbial (<i>Bacillus thuringiensis</i>)	no	no
botanicals (pyrethrins)	yes/no ²	no
oil (horticultural), soap (potash soap)	yes	no
microbial (spinosad)	yes/no ²	yes/no ²
neonicotinoids (imidacloprid)	yes/no ²	yes
carbamates (carbaryl), organophosphates (malathion), pyrethroids (bifenthrin)	yes	yes

1. Direct contact toxicity is killing within several hours from spraying the beneficial or its habitat. Residual toxicity is killing or sublethal effects (such as reduced reproduction or ability to locate and kill pests) due to residues that persist. 2. Toxicity depends on the specific material and how it is applied and the species and life stage of the natural enemy. See the [active ingredients database](#) for more information about specific pesticides.

Resource:

- Quick Tip cards available at <http://www.ipm.ucanr.edu/QT/>
 - Topic choices include: Beneficial Predators, Common Garden Spiders, Parasites of Insect Pests
- Pest Notes available at <http://ipm.ucanr.edu/PMG/PESTNOTES/>
 - Topic choices include: Biological Control and Natural Enemies of Invertebrates
- Natural Enemies Gallery at <http://ipm.ucanr.edu/PMG/NE/>
- Publications by the University of California, Division of Agriculture and Natural Resources.
 - Titles include: *Natural Enemies Handbook*, *Pests of Landscape Trees and Shrubs*, *Pest of the Garden and Small Farm*.
- *Textbook on entomology: The Insects: An Outline of Entomology*, by P J. Gullan and PS. Cranston, Wiley-Blackwell, 2010

♦ Should you need assistance, or, require accommodations for any physical challenge, please call 530-621-5502. ♦
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Friends of the Garden	Garden Pests												
	Aphids	Beetles	Brown garden snail	* Bugs	Caterpillars	Insect eggs	Leafhoppers	Mealybugs	Mites	Psyllids	Scales	Thrips	Whiteflies
Brown lacewings	X			X	X			X	X	X	X		X
Green lacewings	X			X	X			X	X	X	X		X
Spiders	X	X		X	X		X			X		X	X
Bigeyed bugs	X			X	X	X	X		X				X
Damsel bugs	X	X		X	X		X		X			X	
Minute pirate bugs	X				X			X	X	X	X	X	
Dustywings						X		X	X	X			X
Assassin bugs				X	X		X						
Multicolored Asian lady beetle	X									X			X
Soldier beetles, leather-winged beetles	X	X				X							
Anaphes species		X		X									
Convergent lady beetle	X												X
Tachinid flies		X			X								
Trichogramma spp., egg parasite					X	X							
Aphidius species	X												
Aphytis spp., armored scale parasites											X		
Bracon cushmani, grape leaffolder parasite					X								
Citrus mealybug parasite								X					
Cotesia medicaginis, alfalfa butterfly parasite					X								
Cottony cushion scale parasite											X		
Decollate snail			X										
Encarsia formosa, whitefly parasite													X
Elm leaf beetle parasite		X											
Hyposoter exiguae, caterpillar parasite					X								
Lysiphlebus testaceipes, aphid parasites	X												
Mealybug destroyer								X					
Phytoseiulus persimilis									X				
Predaceous ground beetle			X										
Predaceous midge (aphid midge)	X												
Sevenspotted lady beetle	X												
Sixspotted thrips									X				
Spider mite destroyer lady beetle									X				
Syrphid flies	X												
Trioxys pallidus, walnut aphid parasite	X												
Western predatory mite									X				

*Bugs (such as lygus, plant, and stink bugs)

Summarized from: Natural Enemies, Listed by Common Name, at:

<http://ipm.ucanr.edu/PMG/NE/natenemiespest.html>.