



# Current Report

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## Management of Insects and Mites in Greenhouse Floral Crops

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Insect and mite pests of greenhouse crops present unique challenges with respect to their management and control. Plants are frequently moved in and out of the greenhouse, creating opportunities for repeated introduction of pests. Crops are grown year-round in a protected environment that is favorable for pest development. Additionally, greenhouse pests often exist in the absence of their natural enemies unless predators and parasitoids are intentionally introduced.

Many greenhouse pest populations can be reduced by implementing and following a comprehensive integrated pest management (IPM) plan. At a minimum, such a plan should include the following:

- A regular pest monitoring program coupled with careful recordkeeping.
- Implementation of exclusion techniques and careful sanitation practices when handling new plants and growing media.
- Thoroughly clean the greenhouse after each production cycle.
- Keep all openings into the greenhouse (doors, screens, ventilators) in good repair.
- Cultural practices such as mowing grass around the greenhouse to reduce pest harborages.
- Introduction and/or conservation of biological control agents when appropriate.

Chemical pesticides can be part of a comprehensive IPM plan, but should not substitute for good horticultural practices, or be used as "preventative insurance" against pests. Such practices are rarely economically or environmentally justifiable, and provide a recipe for the selection of pests that are resistant to the pesticide. Pesticides should be applied using specified application methods to assure optimal control. It is especially important to follow all safety precautions when applying pesticides in a greenhouse due to its enclosed environment. Follow ALL label directions, especially all Worker Protection Standards. Pesticide recommendations in this publication are correct as of the "Modified Date." Always check the label that came with the purchased pesticide for the most current application directions and restrictions. More information on greenhouse pest management can be found in the following Oklahoma Cooperative Extension Service publications:

- HLA-6707, Pesticide Use and Safety in the Nursery and Greenhouse.
- HLA-6710, Integrated Pest Management in Commercial Greenhouses: An Overview of Principles and Practices.
- HLA-6711, IPM- Scouting and Monitoring for Pests in Commercial Greenhouses.

<i>Pest</i>	<i>Pesticide Common Name</i>	<i>Pesticide Trade Name</i>	<i>Pesticide Class*</i>	<i>REI**</i>	<i>Comments</i>
<b>Aphids</b>	Acephate	Orthene	1B	24	Has foliar-systemic activity as a spray. Check label for phytotoxicity information.
	Abamectin	Avid	6	12	Has foliar-systemic activity as a spray.
	Acetamiprid	Tristar	4A	12	Has foliar-systemic activity as a spray.
	Azadirachtin	Azatin/Ornazin	18B	4/12	Slow acting. Works best when tank mixed with other insecticides.

<i>Pest</i>	<i>Pesticide Common Name</i>	<i>Pesticide Trade Name</i>	<i>Pesticide Class*</i>	<i>REI**</i>	<i>Comments</i>
	<i>Beauveria bassiana</i>	Botanigard/ Naturalis	M	4	Three to five applications may be needed.
	Bifenthrin	Talstar	3	12	
	Chlorpyrifos + Cyfluthrin	Duraplex	1B + 3	24	Aerosol formulation.
	Clothianidin	Celero	4A	12	Has foliar-systemic activity. Apply as a spray or drench.
	Cyfluthrin	Decathlon	3	12	
	Dinotefuran	Safari	4A	12	Systemic insecticides with long residual activity. Highly water soluble.
	Endosulfan	Thiodan	2A	24	
	Fenpropathrin	Tame	3	24	May be combined with Orthene.
	Flonicamid	Aria	9B	12	Has foliar-systemic activity. Apply as a spray or drench.
	Fluvalinate	Mavrik	3	12	
	Imidacloprid	Marathon	4A	12	Systemic insecticide with long residual activity.
	Insecticidal soap	M-Pede/Olympic Insecticidal soap	NS	12	Short residual activity. Thorough coverage of all plant parts is important. Avoid applying at frequent intervals.
	Kinoprene	Enstar II	7A	4	Only works on young aphids.
	Neem oil	Triact Oil	UN	4	Short residual activity. See note 2.
	Paraffinic oil	Sunspray Ultra-Fine Oil	UN	4	Short residual activity. Avoid applying at frequent intervals. See note 2.
	Permethrin	Astro	3	12	
	Pymetrozine	Endeavor	9B	12	Has systemic activity. Prevents insects from feeding by blocking mouthparts.
	Thiamethoxam	Flagship	4A	12	Systemic insecticide. Apply as a spray or drench.
<b>Caterpillars</b>	Acephate	Orthene	1B	24	Check label for phytotoxicity information.
	Azadirachtin	Azatin/Omazin	18B	4/12	Azatin may be used on greenhouse-grown vegetables.
	<i>Bacillus thuringiensis</i> var. <i>kurstaki</i>	Dipel	11B2	4	May be used on greenhouse-grown vegetables. Insects must consume material.
	<i>Beauveria bassiana</i>	Naturalis	M	4	Works best when tank mixed with other insecticides. Three to five applications may be needed.
	Bifenthrin	Talstar	3	12	
	Chlorfenapyr	Pylon	13	12	Has foliar-systemic activity. Do not make more than two applications in sequence, or more than three times total per growing cycle. Check label for phytotoxicity information.

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	Chlorpyrifos + Cyfluthrin	Duraplex	1B + 3	24	Aerosol formulation.
	Cyfluthrin	Decathlon	3	12	
	Diflubenzuron	Adept	15	12	Prevents insects from molting. Cannot be used on poinsettias, hibiscus, or Reiger begonia.
	Fenpropathrin	Tame	3	12	Has beet armyworm activity only.
	Fluvalinate	Mavrik	3	12	
	Permethrin	Astro	3	12	
	Spinosad	Conserve	5	4	
	Tebufenozide	Confirm	18A	4	Disrupts molting of caterpillars.
<b>Fungus Gnats (Adults)</b>	Bifenthrin	Talstar	3	12	
	Chlorpyrifos + Cyfluthrin	Duraplex	1B + 3	24	Aerosol formulation.
	Cyfluthrin	Decathlon	3	12	
	Paraffinic Oil	Sunspray Ultra-Fine Oil	UN	4	Short residual activity. Avoid applying at frequent intervals. See note 2.
	Permethrin	Astro	3	12	
<b>Fungus Gnats (Larvae)</b>	Azadirachtin	Azatin/Ornazin	18B	4/12	Azatin may be used on greenhouse-grown vegetables.
	<i>Bacillus thuringiensis</i> var. <i>israelensis</i>	Gnatrol	11A1	4	Slow acting. May be used on greenhouse-grown vegetables.
	Chlorpyrifos	Duraguard	1B	24	Microencapsulated formulation.
	Chlorfenapyr	Pylon	13	12	Has foliar-systemic activity. Do not make more than two applications in sequence, or more than three applications total per growing cycle. Check label for phytotoxicity information.
	Cyromazine	Citation	17	12	Slow acting.
	Diflubenzuron	Adept	15	12	Prevents insects from molting. Cannot be used on poinsettias, hibiscus, or Reiger begonia. Long residual activity.
	Kinoprene	Enstar II	7A	4	Slow acting.
	Phytoseiid mites		BLO	0	Certain species of these predatory mites are active in the soil. Check label for specific site requirements.
	Pyriproxyfen	Distance	7C	12	Read label for precautions when using on poinsettias.
	<i>Steinernema feltiae</i>	Nemasys/ Scanmask/ Entoneem	BLO	0	Beneficial nematode that attacks fungus gnat larvae. Apply before fungus gnat populations are high. Compatible with many pesticides, but some products may reduce efficacy of nematodes.
<b>Leafminers</b>	Abamectin	Avid	6	12	Active on larvae. Has foliar-systemic activity.
	Acephate	Orthene	1B	24	Active on larvae. Has foliar-systemic activity as a spray. Check label for phytotoxicity information.

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	Azadirachtin	Azatin/Orazin	18B	4/12	Active on larvae. May be used on greenhouse-grown vegetables.
	Cyromazine	Citation	17	12	Active on larvae.
	Permethrin	Astro	3	12	Active on adults.
	Spinosad	Conserve	5	4	Active on larvae. Has foliar-systemic activity.
<b>Mealybugs</b>	Acephate	Orthene	1B	24	Has foliar-systemic activity as a spray. Check label for phytotoxicity information.
	Acetamiprid	Tristar	4A	12	Has foliar-systemic activity as a spray.
	<i>Beauveria bassiana</i>	Botanigard/ Naturalis	M	4	Works best when tank mixed with other insecticides. Three to five applications may be needed.
	Bifenthrin	Talstar	3	12	Works best on crawler stages.
	Buprofezin	Talus	16	12	Works best on crawler stages.
	Clothianidin	Celero	4A	12	Has foliar-systemic activity. Apply as a spray or drench.
	Cyfluthrin	Decathlon	3	12	Works best on crawler stages.
	Fenpropathrin	Tame	3	24	Works best on crawler stages.
	Fonicamid	Aria	9B	12	Has foliar-systemic activity. Apply as a spray or drench.
	Fluvalinate	Mavrik	3	12	Works best on crawler stages.
	Imidacloprid	Marathon	4A	12	Slow acting, long residual systemic insecticide.
	Insecticidal soap	M-Pede/Olympic Insecticidal Soap	NS	12	Short residual activity. Thorough coverage of all plant parts is important. Avoid applying at frequent intervals.
	Kinoprene	Enstar II	7A	4	May be used as a drench for control of root mealybug.
	Neem oil	Triact Oil	HO	4	Short residual activity.
	Paraffinic oil	Sunspray Ultra-Fine Oil	HO	4	Short residual activity. Avoid applying at frequent intervals. See note 2.
	Thiamethoxam	Flagship	4A	12	Systemic insecticide. Applied as a spray or drench.
<b>Mites (Twospotted Spider)</b>	Abamectin	Avid	6	12	Has foliar-systemic activity.
	<i>Beauveria bassiana</i>	Naturalis	M	4	Three to five applications may be needed.
	Bifenazate	Floramite	25	4	Do not make more than two applications per crop per year. Is compatible with use of biological control organisms.
	Bifenthrin	Talstar	3	12	

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	Chlorfenapyr	Pylon	13	12	Has foliar-systemic activity. Do not make more than two applications in sequence, or more than three applications total per growing cycle. Check label for phytotoxicity information.
	Clofentezine	Ovation	10A	12	Works on mite eggs. Is compatible with use of biological control organisms.
	Etoxazole	TetraSan	10B	12	Works on mite eggs, larvae and nymphs. Do not apply more than twice per growing cycle.
	Fenbutatin-oxide	Vendex	12B	48	Works best at temperatures above 70°F.
	Fenpropathrin	Tame	3	24	
	Fenpyroximate	Akari	21	12	Do not rotate with Sanmite.
	Fluvalinate	Mavrik	3	12	
	Hexythiazox	Hexygon	10B	12	Works on mite eggs, larvae and nymphs.
	Insecticidal soap	M-Pede/Olympic Insecticidal Soap	NS	4	Short residual activity. Thorough coverage of all plant parts is important. Avoid applying at frequent intervals.
	Neem oil	Triact Oil	HO	4	Short residual activity.
	Paraffinic oil	Sunspray Ultra-Fine Oil	HO	4	Short residual activity. Avoid applying at frequent intervals. See note 2.
	Phytoseiid mites		BLO	0	Widely used predatory mites of spider mites, including two-spotted spider mite. Check label for specific site requirements for each species.
	Pyridaben	Sanmite	21	12	Do not rotate with Akari.
	Spiromesifen	Judo	23	12	Has translaminar activity. Long residual activity.
<b>Mites (Cyclamen)</b>	Abamectin	Avid	6	12	Has translaminar-systemic activity.
	Chlorfenapyr	Pylon	13	12	Has foliar-systemic activity. Do not make more than two applications in sequence, or more than three applications total per growing cycle. Check label for phytotoxicity information.
	Endosulfan	Thiodan	2A	24	
	Phytoseiid mites		BLO	0	Widely used predatory mites of mite pests. Check label for specific site requirements for each species.
<b>Mites (Broad)</b>	Abamectin	Avid	6	12	Has foliar-systemic activity.
	Bifenthrin	Talstar	3	12	
	Chlorfenapyr	Pylon	13	12	Has foliar-systemic activity. Do not make more than two applications in sequence, or more than three applications total per growing cycle. Check label for phytotoxicity information.

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	Phytoseiid mites		BLO	0	Widely used predatory mites of mite pests. Check label for specific site requirements for each species.
	Pyridaben	Sanmite	21	12	
<b>Scales (Soft and Armored)</b>	Acephate	Orthene	1B	24	Works best on crawler stages. Check label for phytotoxicity information.
	Bifenthrin	Talstar	3	12	Works best on crawler stages.
	Buprofezin	Talus	16	12	Works best on crawler stages.
	Cyfluthrin	Decathlon	3	12	Works best on crawler stages.
	Imidacloprid	Marathon	4A	12	Only active on soft scales.
	Insecticidal soap	M-Pede/Olympic Insecticidal Soap	NS	12	Short residual activity. Thorough coverage of all plant parts is important. Avoid applying at frequent intervals.
	Kinoprene	Enstar II	7A	4	Slow acting. Only active on crawler stages.
	Neem oil	Triact Oil	HO	4	Short residual activity.
	Paraffinic oil	Sunspray Ultra-Fine Oil	HO	4	Short residual activity. Avoid applying at frequent intervals. See note 2.
	Pyriproxyfen	Distance	7C	12	Slow acting. Only active on crawler stages.
<b>Slugs</b>	Iron phosphate	Sluggo	UN	0	Bait formulation.
	Metaldehyde	Deadline	UN	12	Bait formulation.
	Methiocarb	MesuroI	1A	24	Bait formulation.
<b>Thrips</b>	Abamectin	Avid	6	12	Rotate with Conserve and MesuroI.
	Acephate	Orthene	1B	24	Works best when tank mixed with Tame. Check label for phytotoxicity information.
	Azadirachtin	Azatin/Ornazin	18B	4/12	Works best when tank mixed with other insecticides.
	<i>Beauveria bassiana</i>	Botanigard/ Naturalis	M	4	Works best when tank mixed with other insecticides. Three to five applications may be needed.
	Bifenthrin	Talstar	3	12	
	Cyfluthrin	Decathlon	3	12	
	Fenpropathrin	Tame	3	24	Works best when tank mixed with Orthene.
	Fluvalinate	Mavrik	3	12	
	Kinoprene	Enstar II	7A	4	Slow acting. Only active on nymphal stages.
	Novaluron	Pedestal	15	12	Only active on nymphal stages.
Methiocarb	MesuroI	1A	24	Rotate with Conserve and Avid.	
Paraffinic oil	Sunspray Ultra-Fine Oil	HO	4	Short residual activity. Avoid applying at frequent intervals. See note 2.	

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	Phytoseiid mites		BLO	0	Widely used predatory mites of thrips, including western flower thrips. Check label for specific site requirements for each species.
	Spinosad	Conserve	5	4	Avoid using at frequent intervals. Rotate with Mesurool and Avid.
<b>Whiteflies</b>	Abamectin	Avid	6	12	Has foliar-systemic activity as a spray.
	Acephate	Orthene	1B	24	Has foliar-systemic as a spray. Works on nymphs and adults. Check label for phytotoxicity information.
	Acetamiprid	Tristar	4A	12	Has foliar-systemic activity as a spray.
	Azadirachtin	Azatin/Ornazin	18B	4/12	Works best when tank mixed with other insecticides. Active on nymphs.
	<i>Beauveria bassiana</i>	Botanigard/ Naturalis	M	4	Works best when tank mixed with other insecticides. Active on nymphs and adults. Three to five applications may be needed.
	Bifenthrin	Talstar	3	12	Active on nymphs and adults.
	Buprofezin	Talus	16	12	Active on nymphs.
	Clothianidin	Celero	4A	12	Has foliar-systemic activity. Apply as a spray or drench.
	Cyfluthrin	Decathlon	3	12	Active on nymphs and adults.
	Dinotefuran	Safari	4A	12	Systemic insecticide with long residual activity. Highly water soluble.
	<i>Encarsia formosa</i>		BLO	0	Parasitic wasp of greenhouse whitefly.
	Endosulfan	Thiodan	2A	24	May be used on greenhouse-grown tomatoes. Active on nymphs and adults.
	Fenpropathrin	Tame	3	24	Active on nymphs and adults.
	Flonicamid	Aria	9B	12	Has foliar-systemic activity. Apply as a spray or drench.
	Fluvalinate	Mavrik	3	12	Active on nymphs and adults.
	Imidacloprid	Marathon	4A	12	Slow acting, long residual systemic insecticide.
	Insecticidal soap	M-Pede/Olympic Insecticidal Soap	NS	12	Short residual activity. Thorough coverage of all plant parts is important. Avoid applying at frequent intervals. Active on nymphs and adults.
	Kinoprene	Enstar II	7	4	Slow acting. Only active on nymphs.
	Neem oil	Tract Oil	HO	4	Active on nymphs and adults.
	Novaluron	Pedestal	15	12	Active on nymphs.
	Paraffinic oil	Sunspray Ultra-Fine Oil	HO	4	Active on eggs, pupae, nymphs, and adults. Avoid applying at frequent intervals. See note 2.
	Permethrin	Astro	3	12	Active on nymphs and adults.

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	Pymetrozine	Endeavor	9B	12	Has systemic activity. Works on nymphs and adults. Prevents insects from feeding by blocking mouthparts.
	Pyridaben	Sanmite	21	12	Works on nymphs and adults.
	Pyriproxyfen	Distance	7C	12	Only works on nymphs.
	Thiamethoxam	Flagship	4A	12	Systemic insecticide. Applied as a spray or drench.

\* The numbers associated with the pesticide class column were developed by the Insecticide Resistance Action Committee (IRAC) in 2005. This system aids in the selection of insecticides for preventative resistance management. If you make multiple applications for a specific pest or group of pests during a growing production cycle, simply select a registered insecticide with a different number for each generation (14 to 21 days). You can rotate within the same number if more than one subgroup is available (Example: 2A and 2B). To further delay pests from developing resistance, integrate other control methods into your pest management programs.

1A = Carbamate	12A = Diafenthuron
1B = Organophosphate	12B = Organotin miticide
2A = Cyclo diene organochlorine	12C = Propargite
2B = Phenylpyrazole	13 = Chlorfenapyr, DNOC
3 = Pyrethroid	14 =
4A = Neonicotinoid	15 = Benzoylureas
4B = Nicotine	16 = Buprofezin
5 = Spinosyns	17 = Cyromazine
6 = Avermectins	18A = Diacylhydrazine
7A = Juvenile hormone analogues	18B = Azadirachtin
7B = Fenoxycarb	19 = Amitraz
7C = Pyriproxyfen	20A = Hydramethylnon
8A = Methyl bromide (fumigant)	20B = Acequinocyl
8B = Aluminum phosphide (fumigant)	20C = Fluacrypyrim
8C = Sulfuryl fluoride (fumigant)	21 = METI acaricides, Rotenone
9A = Cryolite	22 = Indoxacarb
9B = Pymetrozine	23 = Tetric acid derivatives
9C = Flonicamid	24A = Aluminum phosphide
10A = Clofentezine	24B = Cyanide
10B = Hexythiazox	24C = Phosphine
11A1 = Bt var. israelensis	25 = Bifenazate
11A2 = Bt. var. sphaericus	26 = Fluroacetate
11B1 = Bt. var. aizawai	27A = P450 monooxygenase inhibitors
11B2 = Bt. var. kurstaki	27B = Esterase inhibitors
11C = Bt. var. tenebrionis	28 = Flubendiamide
BLO = Biological Organism	NS = Non-specific, multi-site
M = Microbial	UN = Unknown mode of action
HO = Horticultural Oil	

\*\* REI=Restricted Entry Interval (in hours); workers not allowed to enter into treated area until the REI has elapsed.

#### NOTES:

1. Before purchasing and using any pesticide, read the label carefully for registered use(s), rates, and application frequency. Also, note toxicity category on the label of each pesticide because toxicity ratings may affect reentry intervals, and note any ventilation requirements. Wear protective clothing that is recommended on each pesticide label.
2. When using horticultural oils, it is important not to use oils in conjunction with insecticidal soap or any sulfur-containing compounds. Also, do not use horticultural oils in sprayers in which fungicides have been used. Frequent agitation is required when using horticultural oil sprays.
3. Insecticides having a broad spectrum of activity (e.g., pyrethroids, organophosphates, carbamates, and neonicotinoids) may not be compatible with biological control organisms because they can harm some natural enemies. Some broad-spectrum insecticides are more selective than others, and selectivity further depends on how, when, and where the insecticide is applied. Be sure to check the label for the kinds of insects controlled by the product, or contact your county Extension educator for information on compatibility with biological control organisms.

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