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Managing Pests of Indoor Plantscapes[1]

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As if growing plants outdoors wasn't hard enough, a whole industry has developed around maintaining indoor plantscapes or interiorscapes. The complexity of these indoor plantscapes varies from having a couple of foliage plants on a window sill in a home to elaborate arrangements in restaurants, malls, hotels, private businesses, and public conservatories.

The number of arthropod pests in interiorscapes is considerably smaller than for outdoor plants, and typically include spider mites, fungus gnats, aphids, mealybugs, and scale insects. Some plants are particularly susceptible to infestation, like English ivy or *Schefflera* spp., so their use should be avoided. Of course, the biggest pests might have two legs, and use indoor plants as hiding spots for coffee, gum, cigarette butts, cleaning compounds, or other trash. Monitoring and proper identification of the problem is very important. Several factors should be considered, including plant location in relation to light and air flow, frequency of watering and fertilizing, and plant age. A list of plant symptoms and possible causes is provided in Table 1.

Attempting pest control in these environments can be difficult. Insecticide use is often restricted because of the increased potential for human contact. A limited number of pesticides are labeled for ornamental use in interiorscapes, and pesticide odors may be offensive to folks using an area. The potential for arthropod pests to develop resistance to commonly-used pesticides is also real, so rotating products among different modes of action is important (for more information, see the Insecticide Resistance Action Committee website).

Just remember, “an ounce of prevention is worth a pound of cure.” The best defense against ornamental plant pests is sanitation and isolation. If pests can be excluded, then populations can't build up and cause damage. When an infestation is initially found, separate and isolate the infested plants to prevent spreading the problem, and only treat the affected plants, if possible. Discard or destroy infested plant material quickly, preferably in an area that won't result in an additional outdoor plant infestation.

Here are some ways that arthropods can infest indoor plants:

- Infested plant material is brought in from a nursery or garden center.

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- Arthropods can fly or walk in through open doors or windows.
- Personnel transfer pests with equipment or dust cloths used to clean plant foliage.
- Pests can be transferred among plants if ventilation blows through foliage or if pests are washed off during watering.

Biological control can be very useful in interiorscapes. It has received more interest in recent years because of restrictions on indoor plantscape pesticide applications, pesticide costs, limited control with pesticides, phytotoxicity, and potential human health hazards. To implement a successful biological control program, knowledge of pest and natural enemy biology, a good monitoring program, patience, and commitment to the program are important.

Most pest managers already realize that if a pesticide application is needed, it should be done when the fewest people are around. Those times are usually at night, during weekends, or in some cases, on holidays. Non-applicators should avoid treated plants until the pesticide on the foliage has completely dried, or is otherwise specified on the pesticide label. Examples of pesticides labeled for use in interiorscapes are listed in Tables 2 and 3.

If a pesticide is needed, be careful of causing phytotoxicity, which is also described as a marginal burn, chlorosis, spotting of leaves, or distortion of new growth. Phytotoxic effects may occur if the temperature is too hot, if pesticides are applied too heavily or mixed with some adjuvants. Various pesticide formulations may have different phytotoxic effects. Wettable powders are considered safer to plants than emulsifiable concentrates, but frequently leave unwanted residues on the foliage. Although labels usually contain a list of plants that are sensitive to a pesticide, a trial spray application on a few plants under a particular condition is strongly recommended before treating all plants, regardless of the formulation or mixture.

For More Information

Interiorscapes:

http://ipm.ncsu.edu/InteriorScapes/insect.html

IPM:

http://ipm.ifas.ufl.edu/

Biological control and natural enemies:

http://www.mrec.ifas.ufl.edu/lso/SCOUT/biological.htm

Beneficial insect suppliers:

http://www.cdpr.ca.gov/docs/ipminov/ben_supp/contents.htm

http://www.nysaes.cornell.edu/ent/biocontrol/pathogens/nematodes.html

Photos of beneficials:

http://edis.ifas.ufl.edu/IN002

http://edis.ifas.ufl.edu/IN003

http://edis.ifas.ufl.edu/IN012

http://edis.ifas.ufl.edu/IN013

Table 1. A general diagnostic guide for plants grown indoors.

Symptoms	Potential Causes
Leaf tips are brown or scorched	1) Poor root health from overwatering, soil excessively dry (especially between waterings), excessive fertilizer or other soluble salts in the soil, or root rot disease. 2) Specific nutrient toxicities (e.g., fluoride, copper, or boron). 3) Low humidity. 4) Pesticide or mechanical injury.
Leaf spots, blotches, blemishes, blisters, or scabby spots	1) Intense light (sunburn) associated with a recent move of the plant or excessive soil dryness and wilting. 2) Chilling injury (below 50°F). 3) Pesticide injury. 4) Overwatering. 5) Fungal or bacterial infections (unusual, unless plants have recently come from a field or greenhouse).
Older leaves are yellow-green: Newer leaves are yellow-green: All leaves are yellow-green	1) Insufficient fertilizer, especially nitrogen. 2) Poor root health due to pot-bound growth, compacted soil, or poor drainage. 3) Insufficient light. 4) Senescence (natural aging process, individual leaves). 1) Soil pH (acidity) imbalance. 2) Trace element imbalance. 1) Too much light. 2) Insufficient fertilization. 3) High temperatures, especially if associated with dryness. 4) Insect infestation or root rot disease.
Leaf drop	1) Poor root health from overwatering, excessive dryness, excessive fertilizer or other soluble salts in the soil, compacted soil, or pot-bound roots. 2) Sudden change in light, temperature or relative humidity. 3) Root rot disease.
Foliage is wilting or drooping	1) Poor root health from overwatering, excessive dryness, excessive fertilizer or other soluble salts in the soil, compacted soil, poor drainage, or root rot disease. 2) A toxic chemical poured into the soil.
Roots are brown in color, soft or rotted; Roots have tissue that can easily be “slipped off, leaving behind the string-like center tissues; roots massed at top or bottom of pot.	1) Poor root health from overwatering, excessive dryness, excessive fertilizer or other soluble salts in the soil, compacted soil, or a poorly drained container. 2) A toxic chemical poured into soil. 3) Over or underwatering. 4) Root rot disease.
Leaves have yellowed with tiny speckling; leaves later are bronzed and dried out; webbing occurs near growing points	1) Spider mite infestation.
Leaves or stems coated with a sticky substance; mold growing on leaves, tiny brown or white objects seen on leaves or in crotches of branches; leaf drop or branch dieback; leaf or growing point distorted.	1) Aphid, scale, or mealybug infestation.
Information adapted from Michigan State University Extension Bulleting E-2308 Interiorscape Pest Management. A Training Manual for Commercial Pesticide Applicators. Julie Stachecki, Editor.	

Table 2. Products available for interiorscape insect pest management.

Active Ingredient	Trade Name	Pests Controlled	Comment
Azadirachtin	Azatin XL, Ornazin	Aphids, beetles, borers, caterpillars, flies, leafhoppers, leafminers, leafrollers, moths, psyllids, scales, thrips, and whiteflies	Insect growth regulator - disrupts molting; repels and deters feeding.
Bacillus thuringiensis var. *israelensis*	Gnatrol	Fungus gnats	Microbial gut disruptor.
Bacillus thuringiensis var. *kurstaki*	Foray	Caterpillars	Microbial gut disruptor.
Beauveria bassiana	BotaniGard	Aphids, beetles, mealybugs, psyllids, thrips, whiteflies	Fungal biological control agent.
Bifenazate	Floramite	Two-spotted spider mite, pacific mite, strawberry mite, European red mite, citrus red mite, southern red mite, spruce spider mite, and bamboo spider mite	Use in conjunction with predatory mites and/or other miticides.
Bifenthrin	Talstar	Aphids, broad mites, fungus gnats, grasshoppers, lace bugs, leafhoppers, leafrollers, leafminers, mealybugs, spider mites, and whiteflies	Synthetic pyrethroid
Cyfluthrin	Decathlon, Tempo	Aphids, caterpillars, beetles, grasshoppers, lace bugs, leafhoppers, leafrollers, mealybugs, scales, thrips, whiteflies	Synthetic pyrethroid
Cyomazine	Citation 75 WP	Dipterous leafminers and fungs gnats	Leafminers can develop resistance.
Diflubenzuron	Adept	Armyworms, leafminers and fungus gnats	Insect growth regulator - little or no effect on bees or beneficials.
Fenoxycarb	Precision	Fungus gnats, leafminers, shore flies, thrips, and whiteflies	Insect growth regulator.
Fenpyroximate	Akari 5% SC	Spider mites	Stops mite feeding and egg laying.
Horticultural oil	Sunspray Ultrafine spray oil	Aphids, lace bugs, leafhoppers, leafminers, mealybugs, mites, psyllids, scales, thrips, and whiteflies	Parafin-based oil.
Imidacloprid	Marathon, Merit	Aphids, borers, lace bugs, leafhoppers, leafminers, mealybugs, psyllids, thrips, whiteflies, and white grubs	A systemic insecticide; residual activity.
Insecticidal Soap	M-Pede	Aphids, lace bugs, leafhoppers, mealybugs, psyllids, scales, spider mites, thrips, and whiteflies	Contact insecticide; no residual activity. Powdery mildew curative.
Kinoprene	Enstar II	Aphids, fungus gnats, mealybugs, scales, and whiteflies	Insect growth regulator.

Table 2. Products available for interiorscape insect pest management.

Active Ingredient	Trade Name	Pests Controlled	Comment
Permethrin	Astro	Aphids, caterpillars, fungus gnats, thrips, lace bugs, leafhoppers, leafminers, leafrollers, mealybugs, and whiteflies	A synthetic pyrethroid.
Pymetrozine	Endeavor	Aphids and whiteflies	A systemic insecticide; residual activity. Low toxicity to beneficials.
Pyriproxyfen	Distance IGR	Aphids, fungus gnats, scales, shore flies, and whiteflies	Insect growth regulator, not effective on adults.

Table 3. Insect and mite pesticide options for interiorscape plants. (Be sure specific plant and site are listed on the label).

Pest	Pesticide	Active Ingredient	Trade Name and Formulation
Aphids	F, G	acephate	1300 Orthene TR, Acephate Pro 75 or WSP, Orthene Turf, Tree & Ornamental Spray or 97
	F, G	acetamiprid	TriStar
	G	bifenthrin	Talstar Flowable, Attain TR
	F, G	cyfluthrin	Decathlon 20 WP
	G	cyfluthrin + chlorpyrifos	Duraplex TR
	F, G	endosulfan	Endosulfan 3 EC, 50WP
	F, G	fenpropathrin	Tame 2.4 EC
	F, G	fluvalinate	Mavrik Aquaflow
	F, G	horticultural oil	Sunspray Ultra Fine, Ultra-Fine Oil
	F, G	imidacloprid	Marathon II, 1% G, 60 WP
	G	insecticidal soap	M-Pede, Insecticidal Soap 49.52 CF
	G	kinoprene	Enstar II
	F	malathion	Malathion 57% EC
	F, G	pymetrozine	Endeavor
	F, G	pyrethrin	1100 Pyrethrum TR
	F, G	thiamethoxam	Flagship

Table 3. Insect and mite pesticide options for interiorscape plants. (Be sure specific plant and site are listed on the label).

Pest	Pesticide	Active Ingredient	Trade Name and Formulation
Beetles (including weevils)	F, G	acephate	1300 Orthene TR, Acephate Pro 75 or WSP, Address T/O or WSP, Orthene Turf, Tree & Ornamental Spray or 97
	F, G	azadirachtin	Azatin XL
	F	bifenthrin	Talstar Nursery Granular, Talstar GH, Talstar N
	F	carbaryl	Sevin 80 WSP
	F, G	cyfluthrin	Decathlon 20 WP
	F	diazinon	Diazinon 50W, 50 WSP
	F, G	fenpropathrin	Tame 2.4 EC
	F, G	imidacloprid	Marathon II, 1% G, 60 WP
	F, G	permethrin	Astro
	F, G	spinosad	Conserve SC
Caterpillars	F, G	acephate	1300 Orthene TR, Acephate Pro 75 or WSP, Address T/O or WSP, Orthene Turf, Tree & Ornamental Spray or 97
	F, G	*B. thuringiensis*	Dipel DF, Xentari, Xentari DF
	F, G	bendiocarb	Closure 76 WP
	G	bifenthrin	Talstar Flowable, Attain TR
	F	carbaryl	Sevin 80 WSP
	F, G	tebufenozide	Confirm T/O
	F, G	cyfluthrin	Decathlon 20 WP
	G	cyfluthrin + chlorpyrifos	Duraplex TR
	G	diflubenzuron	Adept
	F, G	spinosad	Conserve SC
Remarks: Apply when larvae are small. They are more difficult to control as they approach maturity. It is especially important to use a speader-sticker with *B. thuringiensis*; this material is not suggested for armyworms beyond the second instar. To reduce phytotoxicity, apply bendiocarb only to point of glisten.			
Fungus Gnat Larvae	F, G	azadirachtin	Azatin XL
	F, G	*B. thuringiensis*	Gnatrol
	F, G	cyfluthrin	Decathlon 20 WP
	G	cyfluthrin + chlorpyrifos	Duraplex TR
	G	cyromazine	Citation 75 WP
	G	diazinon	Knox Out 2 FM
	G	diflubenzuron	Adept
	G	kinoprene	Enstar II

Table 3. Insect and mite pesticide options for interiorscape plants. (Be sure specific plant and site are listed on the label).

Pest	Pesticide	Active Ingredient	Trade Name and Formulation
	F, G	fenoxycarb	Precision 25 WP, Preclude TR
	F, G	pyrethrum	1100 Pyrethrum TR
	F, G	pyriproxyfen	Distance IGR, Pyrigro
	F, G	resmethrin (adult gnats only)	SBP-1382
	F, G	thiamethoxam	Flagship
Lacebugs	F, G	acephate	1300 Orthene TR, Orthene Turf, Tree & Ornamental Spray
	G	bifenthrin	Talstar Flowable, Attain TR
	F	carbaryl	Sevin SL, 80 WSP
	F, G	imidacloprid	Marathon II, 1% G, 60 WP; Merit 75 WP, WSP
	F	malathion	Malathion 57% EC
	F, G	permethrin	Astro
	F, G	thimethoxam	Flagship
Leafminers	F, G	abamectin	Avid 0.15 EC
	F, G	acephate	Orthene Turf, Tree and Ornamental Spray
	F, G	azadirachtin	Azatin XL
	G	bifenthrin	Talstar Flowable, Attain TR
	F, G	permethrin	Astro
	F, G	spinosad	Conserve SC
Mealybugs	F, G	acephate	1300 Orthene TR, Acephate Pro 75 or WSP, Address T/O or WSP, Orthene Turf, Tree & Ornamental Spray or 97
	F, G	acetamiprid	TriStar
	F, G	azadirachtin	Azatin XL
	F, G	bendiocarb	Closure 76 WP
	G	bifenthrin	Talstar Flowable, Attain TR
	F, G	cyfluthrin	Decathlon 20 WP
	G	cyfluthrin + chlorpyrifos	Duraplex TR
	F, G	imidacloprid	Marathon II, 1%G, 60 WP
	F, G	insecticidal soap	M-Pede, Insecticidal Soap 49.52 CF
	G	kinoprene	Enstar II
	F	malathion	Malathion 5EC
	F, G	neem oil	Triact 70
	F, G	other oils	Organocide, Sunspray Ultra Fin, Ultra-Fine Oil
	F, G	pyriproxyfen	Distance IGR, Pyrigro
Mites, Spider	F, G	abamectin	Avid 0.15 EC
	G	bifenthrin	Talstar Flowable, Attain TR

Table 3. Insect and mite pesticide options for interiorscape plants. (Be sure specific plant and site are listed on the label).

Pest	Pesticide	Active Ingredient	Trade Name and Formulation
	F, G	bifenazate	Floramite 50% WP
	G	chlorfenapyr	Pylon 2% EC
	F, G	clofentezine	Ovation SC
	G	cyfluthrin + chlorpyrifos	Duraplex TR
	F, G	etoxazole	Tetrasan
	F, G	fenbutatin-oxide	Vendex 50WP
	G	fenpyroximate	Akari 5% SC
	F	hexythiazox	Hexygon
	F, G	horticultural oil	Sunspray Ultra Fine, Ultra-Fine Oil
	F, G	insecticidal soap	M-Pede, Insecticidal Soap 49.52 CF
	F, G	neem oil	Triact 70
	G	pyridaben	Sanmite 75 WP
	F, G	spinosad	Conserve SC
	G	sulfotepp	Plantfume 103
Mites, Broad & Cyclamen	F	chlorfenapyr	Pylon
	G	endosulfan	Endosulfan 3 EC, 50WP Thiodan 3EC
Scales	F, G	acephate	1300 Orthene TR, Acephate Pro 75 or WSP, Address T/O or WSP, Orthene Turf, Tree & Ornamental Spray or 97
	F, G	azadirachtin	Azatin XL
	G	cyfluthrin + chlorpyrifos	Duraplex TR
	F, G	oil	Sunspray Ultra Fine, Ultra-Fine Oil, Organocide
	F, G	imidacloprid	Marathon II, 1% G, 60 WP
	F, G	insecticidal soap	M-Pede, Insecticidal Soap 49.52 CF
	G	kinoprene	Enstar II
	F	malathion	Malathion 5EC
	F, G	pyriproxyfen	Distance IGR, Pyrigro
	F, G	thiamethoxam	Flagship
Shoreflies	G	cyfluthrin + chlorpyrifos	Duraplex TR
	G	cyromazine	Citation 75 WP
	G	diflubenzuron	Adept
	F, G	fenoxycarb	Precision 25 WP, ME, Preclude TR
	F, G	pyriproxyfen	Distance IGR, Pyrigo

Table 3. Insect and mite pesticide options for interiorscape plants. (Be sure specific plant and site are listed on the label).

Pest	Pesticide	Active Ingredient	Trade Name and Formulation
Silverfish (Sweetpotato) Whitefly and Other Whiteflies	F, G	abamectin	Avid 0.15 EC
	F, G	acetamiprid	TriStar
	F, G	azadirachtin	Azatin XL
	G	bifenthrin	Talstar Flowable, Attain TR
	F, G	endosulfan	Endosulfan 3 EC, 50WP Thiodan 3 EC
	F, G	fenpropathrin + acephate	Tame 2.4 EC + orthene
	F, G	horticultural oil	Sunspray Ultra Fine, Ultra-Fine Oil
	F, G	imidacloprid	Marathon II, 1%G, 60 WP
	F, G	insecticidal soap	M-Pede, Insecticidal Soap 49.52 CF
	G	kinoprene	Enstar II
	F, G	pymetrozine	Endeavor
	F, G	pyriproxyfen	Distance IGR, Pyrigro
	G	sulfotepp	Plantfume 103
	F, G	thiamethoxam	Flagship
Remarks: Unlike other whiteflies, the silverleaf whitefly is very difficult to control. To minimize additional resistance problems, one of the above insecticides should be applied two times per week throughout one life cycle (3 weeks) to control an established infestation. (Does not apply to Marathon granules). Insecticidal soap is also effective; however, phytotoxicity may occur when applied repeatedly. Monitor the population to determine if the particular insecticide being applied is reducing whitefly numbers. Some populations may be resistant to one or more of these insecticides. If the infestation persists, use another compound from the above, following the same schedule. Do not apply tank mixes, (except Tame + Orthene) as they may enhance resistance. If low numbers of whiteflies persist, apply one of the above insecticides once per week for 3 weeks, then switch insecticides. Undersides of leaves must be covered thoroughly to achieve satisfactory control. Phytotoxicity of these insecticides has not been extensively evaluated. Plants may be damaged, sometimes severely, with any pesticide. Be sure the pesticide is labeled for your particular crop, and closely follow all label directions.			
Slugs and Snails	F, G	methiocarb	Mesurol 75 W
	F, G	metaldehyde	Deadline Bullets, M-Ps, Metaldehyde 3.5G, 7.5G
Springtails	F, G	insecticidal soap	Insecticidal Soap 49.52 CF
	F, G	malathion	Malathion 5EC