

# Solutions for Control

## Nursery



## Volume III



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# Product Description

Description of products listed for management of insects, mites, plant pathogens and weeds

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## Insecticides, Miticides

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### Azatin® XL – Insect Growth Regulator

Signal Word: Caution

REI: 4 hours

Application rates: 8-16 fluid ounces per 100 gallons; 21 fluid ounces per acre.

Azatin XL is a botanical insecticide/insect growth regulator containing azadirachtin. It can be applied as a foliar spray or drench. Azatin XL can be used alone as an insect growth regulator or in a tank mix with products such as Decathlon or Marathon.

*Azatin is a registered trademark of Certis USA*

### Decathlon® 20 WP – Synthetic Pyrethroid

Signal Word: Caution

REI: 12 hours

Application rates: 1.3 to 1.9 ounces per 100 gallons.

Decathlon is a wettable powder formulation and is also available in water soluble packaging. Decathlon can be used alone for control of a wide range of crawling and flying insect pests on ornamental crops, or in a tank mix with products such as Azatin XL or Marathon for additional activity.

*Decathlon is a registered trademark of OHP, Inc.*

### Deliver® – Biological Insecticide

Signal Word: Caution

REI: 4 hours

Application rates: 1/4 to 1 1/4 pounds per 100 gallons.

Deliver is a microbial insecticide containing *Bacillus thuringiensis* subspecies *kurstaki*. That is effective for control of caterpillar pests such as loopers, leafrollers, European corn borer and cutworms.

*Deliver is a registered trademark of Certis USA*

### Discus™ – Nursery Insecticide

Signal Word: Caution

REI: 12 hours

Application rates: Foliar, 25-50 fluid ounces per 100 gallons; banded soil surface spray or via irrigation, 3.4 to 5.6 fluid ounces per 1000 sq. ft.; OR .75-1.5 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height.

Container drench, 13 fluid ounces can be used to drench varying numbers of containers based on diameter, volume or plant size.

Discus Nursery Insecticide is a liquid flowable formulation combination of imidacloprid and cyfluthrin. It may be applied as a banded or broadcast spray to the soil surface, by irrigation, as a drench to the root zone and as a foliar spray. Discus has systemic activity when applied to the soil (8–10 weeks control) and translaminar activity when sprayed (30 days control).

*Discus is a trademark of OHP, Inc.*

### Judo™ – Greenhouse and Nursery Ornamental Miticide/Insecticide

Signal Word: Caution

REI: 12 hours

Application rates: 1 to 4 fluid ounces per 100 gallons

Judo is a liquid flowable translaminar miticide/insecticide that is applied as a foliar spray. Judo is active against all development stages of a wide range of mites and whiteflies. Residual activity is 30 or more days.

*Judo is a trademark of OHP, Inc.*

## Marathon® 1% G – Systemic Insecticide

Signal Word: Caution REI: 0–12 hours (read label)

Application rates: Depends on container size.

Marathon 1% Granular systemic insecticide is applied topically to the growing media or incorporated prior to planting. Marathon has systemic activity (8–10 weeks control).

*Marathon is a registered trademark of OHP, Inc.*

## Marathon® 60WP in WSP – Systemic and Translaminar Insecticide

Signal Word: Caution REI: 0–12 hours (read label)

Application rates: **Foliar**, 1 20-gram packet per 100 gallons. **Drench**, 1 20-gram packet can be used for varying numbers of containers based on diameter, volume or plant size.

Marathon 60WP is a wettable powder formulation in water soluble packaging. It can be applied as a drench, via chemigation, subirrigation and as a foliar spray. Marathon 60WP has systemic activity (8–10 weeks control) when applied to the root zone and translaminar when sprayed (14-28 days control).

*Marathon is a registered trademark of OHP, Inc.*

## Marathon® II – Systemic and Translaminar Insecticide

Signal Word: Caution REI: 0–12 hours (read label)

Application rates: Foliar, 1.7 fluid ounces (50 ml) per 100 gallons; drench, 1.7 fluid ounces (50 ml) can be used to drench varying numbers of containers based on diameter, volume or plant size.

Marathon II is a liquid flowable formulation. It can be applied as a drench, via chemigation, subirrigation and as a foliar spray. Marathon II has systemic activity when applied to the root zone (8–10 weeks control) and translaminar activity when sprayed (14–28 days control).

*Marathon is a registered trademark of OHP, Inc.*

## Triact® 70 – Clarified Hydrophobic Extract of Neem Oil

Signal Word: Caution REI: 4 hours

Application rates: 1/2 to 2 gallons per 100 gallons.

Triact 70 is an effective insecticide and fungicide used as a rotational component of an insect, mite or plant disease control program.

*Triact is a registered trademark of Certis USA.*

## Fungicides

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### OHP Aliette® WDG – Fungicide

Signal Word: Caution REI: 12 hours

Application rates: Foliar spray, 1 1/4 to 5 pounds per 100 gallons. Drench, 6.4-12.8 ounces per 100 gallons, applied to 400 square feet.

OHP Aliette is a wettable powder formulation containing aluminum tris (fosetyl – AL). OHP Aliette is a systemic preventive and curative fungicide that controls several major diseases of ornamental plants. OHP Aliette also enhances the relationship between the plant's root system and beneficial soil organisms. OHP Aliette can be applied as a foliar spray, soil drench, or incorporated into the soil.

*Aliette is a registered trademark of Bayer.*

### **OHP Chipco® 26019 N/G – Fungicide**

Signal Word: Caution

REI: 12 hours

Application rates: Foliar spray, 1-2 pounds per 100 gallons; drench, 6 1/2 ounces per 250 gallons, and apply 1-2 pints per square foot.

OHP Chipco 26019 N/G is a wettable powder formulation containing iprodione. OHP Chipco 26019 N/G is a contact curative and preventive fungicide that inhibits germination of fungal spores and growth of fungal mycelium. OHP Chipco 26019 N/G may be applied to a wide range of ornamental plants as a foliar spray, drench or dip.

*Chipco is a registered trademark of Bayer.*

### **OHP 26 GT®-O or Sextant™ – Fungicide**

Signal Word: Caution

REI: 12 hours

Application rates: Foliar spray, 1-2.5 quarts per 100 gallons; drench, 13 fluid ounces per 100 gallons of water applied at 1-2 pints per square foot.

OHP 26 GT-O and Sextant are liquid formulations containing iprodione. They are contact, curative and preventive fungicides that inhibit germination of fungal spores and growth of fungal mycelium. Applications may be made to a wide range of ornamental plants as foliar sprays, drenches or dips.

*Sextant is a trademark of OHP, Inc.*

*26 GT is a registered trademark of Bayer.*

### **Compass® O 50WDG – Strobilurin Fungicide**

Signal Word: Caution

REI: 12 hours

Application rates: Foliar spray, 1-4 ounces per 100 gallons; drench, 1/2 - 2 ounces per 100 gallons.

Compass O 50WDG prevents or controls a wide range of foliar and root diseases of ornamental crops. Compass O is absorbed by the wax layer and moves within the treated leaves. It is also active through vapor movement.

*Compass is a registered trademark of Bayer.*

### **OHP 6672™ – Ornamental Fungicide**

Signal Word: Caution

REI: 12 hours

Application rates: 4.5 L application rates: Foliar spray, 10-20 fluid ounces per 100 gallons; drench, 20 fluid ounces per 100 gallons of water applied to 800 square feet.

50 W application rates: Foliar spray, 8-24 ounces per 100 gallons; drench, 12-16 ounces per 100 gallons of water applied at 1-3 pints per square foot.

OHP 6672 controls a broad range of ornamental diseases including, anthracnose, black spot, botrytis, leaf spot, powdery mildew and scab to name a few.

*OHP 6672 is a trademark of OHP, Inc.*

### **SoilGard® 12G – Microbial Fungicide**

Signal Word: Caution

REI: 4 hours

Application rates: Drench, 1/2 to 2 pounds per 100 gallons. Also may be incorporated prior to planting.

SoilGard is a greenhouse, nursery and interiorscape microbial fungicide. SoilGard controls damping-off and root rot pathogens on ornamental and food crops. SoilGard works as a preventative and will protect noninfected plants for months.

*SoilGard is a registered trademark of Certis USA.*

## Strike® 50 WDG – Systemic Fungicide

Signal Word: Caution

REI: 12 hours

Application rates: 1-2 ounces per 100 gallons, except as noted for specific diseases.

Strike will control or prevent many fungal diseases on ornamental plants in the greenhouse and nursery environments. Diseases include flower blight, leaf blight/spot, powdery mildew, rusts and tip blights. Strike works from inside the plant to actively control diseases before symptoms occur and will provide residual control for 30 days or more.

*Strike is a registered trademark of OHP, Inc.*

## Triact® 70 – Clarified Hydrophobic Extract of Neem Oil

Signal Word: Caution

REI: 4 hours

Application rates: 1/2 to 2 gallons per 100 gallons.

Triact 70 is an effective insecticide and fungicide used as a rotational component of an insect, mite or plant disease control program.

*Triact is a registered trademark of Certis USA.*

## Herbicide

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### Ronstar® – Preemergent Herbicide

Signal Word: Warning

REI: 12 hours

Application rates: Ronstar 50 WSP, 4-8 water soluble packets per acre in a minimum of 50 gallons of water; Ronstar G, 100-200 pounds per acre.

Ronstar can provide season-long control of 25 broadleaf and grassy weeds, including goosegrass and *Poa annua* in ornamental nurseries.

*Ronstar is a registered trademark of Bayer.*

## Soil Media Wetting Agent and Moisture Management

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### Suffusion™ – Wetting, Penetrating, Re-Wetting Agent

Signal Word: Caution

REI: N/A

Application rates: May be incorporated, drenched, or applied in irrigation water (see label).

Suffusion offers uniformity to the water media relationship. Growing media that receives water uniformly also effectively creates air to water ratios that are also consistent. All this helps to provide the optimum growing environment for your plants, avoiding plant stress and enhancing utilization of the complete growing media volume.

*Suffusion is a trademark of Amega Sciences.*

# Flathead and Roundheaded Borers

Order Coleoptera Families Buprestidae and Cerambycidae

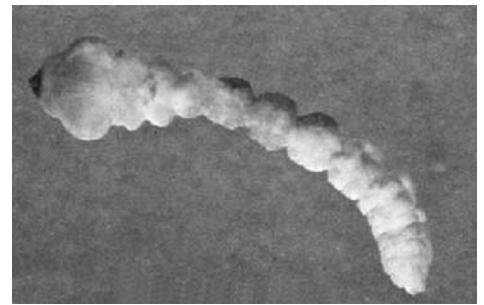
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Flatheaded borer (*Buprestidae*) adults are usually bright colored metallic beetles just under 1 inch long. Larvae do not have legs and have obviously enlarged segments toward the head (the flathead look). Roundheaded borer (*Cerambycidae*) adults are fairly large, from 0.5 to 2 inches and have very long antennae – often longer than the body.

Larvae of both borers tunnel under tree bark, usually in the wood layer. Flat-headed borer galleries are tightly packed with very fine dust, whereas galleries of roundheaded borers contain coarser material. Exit holes of flatheaded borers tend to be flattened or oval and roundheaded borer exit holes tend to be more rounded.

Both borer types tend to attack weakened – or even recently dead – trees, but some flatheaded borers (e.g. emerald ash borer) will attack apparently healthy trees.

Most of these borers have one generation per year, but some have more than one generation per year, and others have a multi year life cycle.



Flathead borer larva



Adult Flathead borer

## Discus™ – Nursery Insecticide

Systemic applications must be made before trees become infested for best results. Apply 3.4 to 5.6 fluid ounces per 1000 ft<sup>2</sup> as a banded spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone; OR apply .75–1.5 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench. Apply in early spring or in the autumn.

## Marathon® II – Systemic and Translaminar Insecticide

Systemic applications must be made before trees become infested for best results. Apply 0.1–0.2 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench. Apply in early spring or in the autumn. Shake well before use.

## Marathon® 60WSP – Systemic and Translaminar Insecticide

Systemic applications must be made before trees become infested for best results. Apply one 20 gram packet per 8 to 16 inches of cumulative trunk diameter (at breast height) or per 8 to 16 feet of cumulative shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench. Apply in early spring or in the autumn.

# Root Weevils

Order Coleoptera, Family Curculionidae

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Root weevils are larvae of snout nosed beetles – usually flightless and all females – that feed on roots of a wide range of plants. Several species can be serious pests in nurseries and greenhouses. Some root weevil pests include the black vine weevil, strawberry root weevil, rough strawberry root weevil, clay colored weevil and woods weevil. Depending on the species, adults range from 1/5 to 1/2 inch long.

Root weevils will spend the winter as adults in some parts of the U.S, but in most areas root weevils winter as larvae in the soil. Larvae pupate and adults of many species emerge in early to late spring – in greenhouses emergence can be much earlier. In the Pacific Northwest, adults can emerge well into summer. Adults need to feed on plants for 3 – 6 weeks before beginning to lay eggs. Adult weevil injury usually appears as semicircular notches on leaf margins. Developing buds may also be damaged. Feeding occurs at night. Adults can remain active for several months.

Eggs are laid in the soil or in debris near host plants. Larvae feed on roots and root hairs, passing through five or six instars. Older larvae may girdle entire stems. Larvae have brown heads, are usually white to cream colored, legless and C-shaped. Injured plants in nurseries and greenhouses may die suddenly. Outdoors there is one generation per year. In greenhouses there may be two generations.

## Discus™ – Nursery Insecticide

For control of root weevil adults and larvae, apply 3.4 to 5.6 fluid ounces per 1000 ft<sup>2</sup> as a banded spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone; OR apply .75–1.5 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench; OR mix 13 fluid ounces (385 ml) in the appropriate amount of water for containers (see label). Apply when adults are laying eggs to target the very young larvae.

Apply 25 fluid ounces per 100 gallons as a foliar spray to target adults. Apply when feeding injury first appears.

## Marathon® II – Systemic and Translaminar Insecticide

For control of root weevil adults and larvae, apply 1.7 fluid ounces in the appropriate amount of water for smaller containers (see label), or 0.1–0.2 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench. Apply when adults are laying eggs to target the very young larvae. Shake well before use.

## Marathon® 60WP in WSP – Systemic and Translaminar Insecticide

For control of root weevil adults and larvae, apply one 20 gram packet in the appropriate amount of water for smaller containers (see label), or one 20 gram packet per 8 to 16 inches of cumulative trunk diameter (at breast height) or per 8 to 16 feet of cumulative shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench; OR mix 1.7 fluid ounces (50 ml) in the appropriate amount of water for containers (see label). Apply when adults are laying eggs to target the very young larvae.

## Marathon® 1% G – Systemic Insecticide

Marathon® 1% Granular systemic insecticide is applied topically to the growing media or incorporated prior to planting. Media incorporation has provided excellent root weevil larval control. Apply when adults are laying eggs to target the very young larvae.

## Azatin® XL – Insect Growth Regulator

Apply 21 fluid ounces per acre as a foliar and soil application for larval control. The pH of the spray solution should be maintained between 3 and 7. For best results use a spray adjuvant. Repeat applications at 5–7 day intervals. Always read the label.

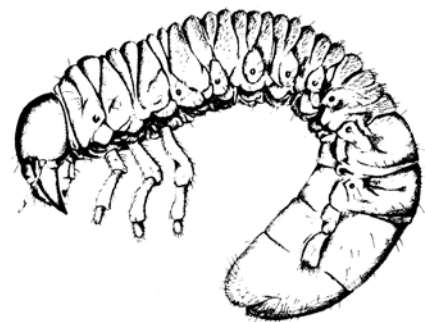
# White Grubs

*Order Coleoptera, Family Scarabaeidae*

White grubs are general names for larvae of several species of beetles. Some of the more important white grubs in nurseries include the Japanese beetle, green June beetle, May beetle, European chafer, Oriental beetle, Asiatic garden beetle and rose chafer.

Larvae are C-shaped and have three pairs of legs. The larvae can be quite large, about 1–2 inches when fully developed. The larvae damage plants by feeding on plant roots. Some (e.g. Japanese beetle) are quarantine pests, requiring special treatment before plants can be shipped. The adults of some species feed during the day, others feed at night – usually on leaves and flowers.

White grub larvae develop in the soil. There usually is one generation per year, but some species (e.g. May–June beetles) have two year larval development





cycles where adults emerge every three years. Adult emergence is in the spring and summer. After mating, eggs are deposited in/on the soil, and larvae move down into the soil to feed following egg hatch.

**Note:** Both Discus and Marathon are approved treatments under the Japanese Beetle Harmonization Program.

### Discus™ – Nursery Insecticide

For larval control, apply 13.5 to 17 fluid ounces per 1000 feet of row or 3000 ft<sup>2</sup> as a banded spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone. Use at least 2 gallons of spray volume per 1000 ft<sup>2</sup>; OR mix 13 fluid ounces (385 ml) in the appropriate amount of water for containers (see label). Apply when adults are laying eggs to target the very young larvae – May through July.

### Marathon® II – Systemic and Translaminar Insecticide

For larval control, apply 1.7 fluid ounces (50 ml) per 1000 feet of row or 3000 ft<sup>2</sup> as a banded spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone. Use at least 2 gallons of spray volume per 1000 ft<sup>2</sup>; OR mix 1.7 fluid ounces (50 ml) in the appropriate amount of water for containers (see label). Apply when adults are laying eggs to target the very young larvae – May through July. Shake well before use.

### Marathon® 60WP in WSP – Systemic and Translaminar Insecticide

For larval control apply one 20 gram packet per 1000 feet of row or 3000 ft<sup>2</sup> as a banded spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone. Use at least 2 gallons of spray volume per 1000 ft<sup>2</sup>; OR mix one 20 gram packet in the appropriate amount of water for containers (see label). Apply when adults are laying eggs to target the very young larvae – May through July.

### Marathon® 1% G – Systemic Insecticide

Apply 45 ounces per 1000 feet of row or 3000 ft<sup>2</sup> as a uniform band on the soil surface. See label for container application rates. Apply when adults are laying eggs to target the very young larvae – May through July.

## Leafhoppers and Sharpshooters

*Order Homoptera, Family Cicadellidae*

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Some of the most important leafhopper and sharpshooter species in greenhouse and nursery production include the potato leafhopper, rose leafhopper, aster leafhopper and glassywinged sharpshooter.

Leafhoppers are small sucking insects. Adults are usually quite small, about 1/4-inch long and wedge-shaped – although some are 1/2-inch or more long. Most species feed on phloem or xylem tissue, but some (e.g. potato leafhopper) feed in leaf mesophyll. Damage ranges from leaf stippling and distortion to marginal necrosis (“hopperburn”). Damage from potato leafhoppers can be quite severe on some nursery grown trees. In addition to feeding injury, some species can transmit plant pathogens. The aster leafhopper transmits the phytoplasma causing aster yellows, which affects a wide range of ornamental and vegetable crops. Glassywinged sharpshooters transmit the bacteria which cause the disease called Pierce’s Disease on grapes. This is a quarantine issue for nursery ornamentals producers in California. Sharpshooters feed on xylem tissue.

Leafhopper adult females insert eggs in small groups in leaves or stems. Nymphs and adults are active, moving sideways on the leaf surface. Adults have wings and are capable of flying considerable distances. Potato leafhoppers overwinter as adults near the Gulf coast and migrate to northern states in the spring and summer.



## Discus™ – Nursery Insecticide

Apply 25 fluid ounces per 100 gallons as a foliar spray; OR apply 3.4 to 5.6 fluid ounces per 1000 ft<sup>2</sup> as a spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone. Use at least 2 gallons of spray volume per 1000 ft<sup>2</sup>; OR apply .75–1.5 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench; OR mix 13 fluid ounces (385 ml) in the appropriate amount of water for drenching containers of different sizes (see label).

## Marathon® II – Systemic and Translaminar Insecticide

Apply 1.7 fluid ounces (50 ml) per 100 gallons as a foliar spray; OR mix 1.7 fluid ounces in the appropriate amount of water for drenching containers of different sizes (see label); OR apply 0.1–0.2 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench. Shake well before use.

## Marathon® 60WP in WSP – Systemic and Translaminar Insecticide

Mix one 20 gram packet in the appropriate amount of water for drenching containers of different sizes (see label) OR apply one 20 gram packet per 8 to 16 inches of cumulative trunk diameter (at breast height) or per 8 to 16 feet of cumulative shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench.

## Marathon® 1% G – Systemic Insecticide

Marathon® 1% Granular systemic insecticide is applied topically to the growing media or incorporated prior to planting.

See label for application rates for different container sizes; OR Apply 15 ounces per 1000 ft<sup>2</sup>.

## Decathlon® 20 WP – Synthetic Pyrethroid

Apply 1.9 ounces (54 grams) per 100 gallons as a foliar spray to control leafhopper nymphs and adults. Tank mix with Azatin XL insect growth regulator to improve control of nymphs. Repeat applications at 5–7 day intervals.

## Azatin® XL – Insect Growth Regulator

Apply 10 to 16 fluid ounces per 100 gallons to target nymphs. Tank mix with Decathlon 20 WP synthetic pyrethroid to target nymphs and adults. The pH of the spray solution should be maintained between 3 and 7. For best results use a spray adjuvant. Repeat applications at 5–7 day intervals.

## Triact® 70 – Clarified Hydrophobic Extract of Neem Oil

Triact 70 is an effective insecticide used as a rotational component of a control program. Mix 1–2 gallons per 100 gallons and apply as a foliar spray. Repeat applications at 7–14 day intervals depending on the severity of infestation. Before mixing, shake well. Mix in water with a temperature greater than 45° F. Avoid contact with open blooms unless you have local experience. Do not apply if temperatures are above 90° F.

# Plant Bugs

*Order Hemiptera, Family Miridae*

Plant bugs are so called “true bugs”. Plant bugs are sucking pests that feed on plant fluids. Damage includes a variety of symptoms, from dark leaf spots to deformed terminal growth. One of the most serious pests among the true bugs is the tarnished plant bug, *Lygus lineolaris*. This pest occurs throughout much of North America and has been recorded from nearly 400 host plants, including many herbaceous and woody ornamentals.

Tarnished plant bugs overwinter as adults in sheltered areas (e.g. leaf debris, under bark, in rock piles) and become active when temperatures warm in the spring. Adults fly to host plants and begin feeding. Eggs are laid into plant tissue such as leaf petioles, the base of the leaf blade or small flowers.



Nymphs emerge from the eggs in 7 to 10 days and begin feeding. The nymphs pass through five stages before becoming adults. The egg to adult life cycle takes about 21 to 28 days. There are two to five generations per year, depending on geographical location.

### **Discus™ – Nursery Insecticide**

Apply 25 – 50 fluid ounces per 100 gallons as a foliar spray; OR apply 3.4 to 5.6 fluid ounces per 1000 ft<sup>2</sup> as a spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone. Use at least 2 gallons of spray volume per 1000 ft<sup>2</sup>; OR apply .75–1.5 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench; OR mix 13 fluid ounces (385 ml) in the appropriate amount of water for drenching containers of different sizes (see label).

### **Decathlon® 20 WP – Synthetic Pyrethroid**

Apply 1.9 ounces (54 grams) per 100 gallons as a foliar spray to control plant bug nymphs and adults. Tank mix with Azatin XL insect growth regulator to improve control of nymphs. Repeat applications at 5–7 day intervals.

## **Leaf Feeding Beetles**

*Order Coleoptera, Family Chrysomelidae*

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There are numerous species of beetles in this family – about 1500 – that feed on plant leaves, including those on many ornamental plants. Some of the more important members of this group for ornamentals producers include cucumber beetles (also known as corn rootworm adults), elm leaf beetles, viburnum leaf beetles, cranberry rootworm adults and flea beetles.

As their name implies, most leaf beetles feed on leaves and flowers as adults and larvae. Larvae of some species feed on plant roots. Larvae often eat only part way through the leaf surface leaving a thin semi-transparent window of tissue between the leaf veins. Adults chew holes completely through the leaf. Injury is usually on the interior areas of leaves, not the edges as with root weevil adults

The life cycles of different species varies. Some overwinter as adults, others as larvae and still others as eggs. The number of annual generations also varies with species and geography.



### **Discus™ – Nursery Insecticide**

Apply 25 fluid ounces per 100 gallons as a foliar spray; OR apply 3.4 to 5.6 fluid ounces per 1000 ft<sup>2</sup> as a spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone. Use at least 2 gallons of spray volume per 1000 ft<sup>2</sup>; OR apply .75–1.5 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench; OR mix 13 fluid ounces (385 ml) in the appropriate amount of water for drenching containers of different sizes (see label).

### **Marathon® II – Systemic and Translaminar Insecticide**

Apply 1.7 fluid ounces (50 ml) per 100 gallons as a foliar spray; OR mix 1.7 fluid ounces in the appropriate amount of water for drenching containers of different sizes (see label); OR apply 0.1–0.2 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench. Shake well before using.

### **Marathon® 60WP in WSP – Systemic and Translaminar Insecticide**

Mix one 20 gram packet in the appropriate amount of water for drenching containers of different sizes (see label) OR apply one 20 gram packet per 8 to 16 inches of cumulative trunk diameter (at breast height) or per 8 to 16 feet of cumulative shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench.

## Marathon® 1% G – Systemic Insecticide

Marathon® 1% Granular systemic insecticide is applied topically to the growing media or incorporated prior to planting. See label for application rates for different container sizes; OR Apply 15 ounces per 1000 ft<sup>2</sup>.

## Decathlon® 20 WP – Synthetic Pyrethroid

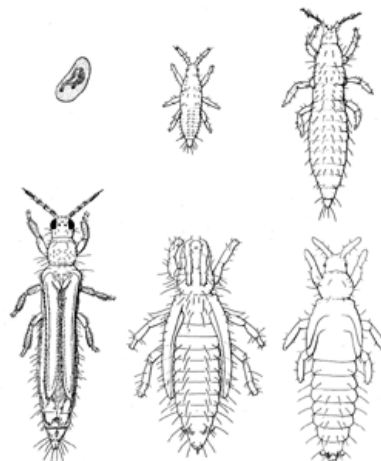
Apply 1.9 ounces (54 grams) per 100 gallons as a foliar spray to control adults. Tank mix with Azatin XL insect growth regulator to improve control of larvae. Repeat applications at 5–7 day intervals.

# Thrips

*Order Thysanoptera, Family Thripidae*

Thrips feed by rasping and sucking plant fluids. Feeding injury distorts and discolors leaves and flowers. Feeding on pollen causes premature senescence. Several species transmit viruses, including tomato spotted wilt virus (TSWV) and impatiens necrotic spot virus (INSV). Western flower thrips prefer to feed in flowers, but will also survive on leaves. They can occur and cause problems on nearly all greenhouse plants.

Thrips develop from egg to adult in 10–15 days (76°–86°F, 25°–30°C) to 57 days (54°F, 12°C). Hot and dry conditions are best for development. The developmental stages are egg, larva (two instars), pseudopupa (two transformation stages, usually off the plant), and adult. In general, any environmental stress that weakens plants makes them more thrips-susceptible (e.g. moisture stress, mildew). Wet conditions retard development.



## Discus™ – Nursery Insecticide

Apply 25 fluid ounces per 100 gallons as a foliar spray; OR apply 3.4 to 5.6 fluid ounces per 1000 ft<sup>2</sup> as a spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone. Use at least 2 gallons of spray volume per 1000 ft<sup>2</sup>; OR apply .75–1.5 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench; OR mix 13 fluid ounces (385 ml) in the appropriate amount of water for drenching containers of different sizes (see label)

## Marathon® II – Systemic and Translaminar Insecticide

Apply 1.7 fluid ounces (50 ml) per 100 gallons as a foliar spray; OR mix 1.7 fluid ounces in the appropriate amount of water for drenching containers of different sizes (see label); OR apply 0.1–0.2 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench. Shake well before using.

## Marathon® 60WP in WSP – Systemic and Translaminar Insecticide

Mix one 20 gram packet per 100 gallons as a foliar spray; OR mix one 20-gram packet in the appropriate amount of water for drenching containers of different sizes (see label) OR apply one 20 gram packet per 8 to 16 inches of cumulative trunk diameter (at breast height) or per 8 to 16 feet of cumulative shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench.

## Marathon® 1% G – Systemic Insecticide

Marathon® 1% Granular systemic insecticide is applied topically to the growing media or incorporated prior to planting. See label for application rates for different container sizes; OR Apply 15 ounces per 1000 ft<sup>2</sup>.

## Azatin® XL – Insect Growth Regulator

Apply 12 to 16 fluid ounces per 100 gallons to target thrips larvae. Tank mix with Decathlon 20 WP to target adults and larvae. The pH of the spray solution should be maintained between 3 and 7. For best results use a spray adjuvant. Repeat applications at 5 to 7 day intervals.

## Decathlon® 20 WP – Synthetic Pyrethroid

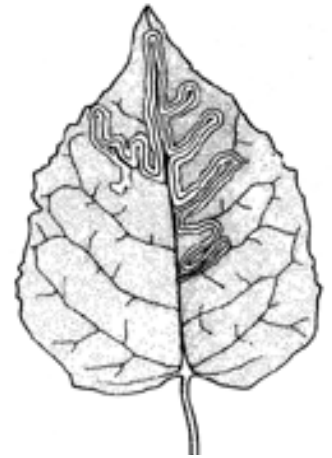
Apply 1.9 ounces (54 grams) per 100 gallons to target adults. Tank mix with Azatin XL insect growth regulator to target both larvae and adults. Repeat at 5 to 7 day intervals.

# Leafminers

*Order Diptera, Family Agromyzidae*

Primary leafminer injury is from the larvae feeding within leaves, making a narrow winding trail, or mine. Larval mines disfigure ornamental plants and vegetable plants may have reduced yields if populations are high. During heavy infestations, larvae may produce leaf mines in flowers. Adult leafminer flies puncture leaves for feeding and egg-laying, and the small white spots will indicate leafminer activity. Leafminers have a very wide host plant range.

Leafminers develop from egg to adult in 14 days (95°F, 35°C) to 64 days (59°F, 15°C). Other species have different lower and upper limits for development, but development trends are similar. The developmental stages are egg, larva (three instars), and pupa (depending on the species, this stage may occur on or off the plant). Leafminers generally do best when plants are high in nitrogen.



## Discus™ – Nursery Insecticide

Apply 25 fluid ounces per 100 gallons as a foliar spray; OR apply 3.4 to 5.6 fluid ounces per 1000 ft<sup>2</sup> as a spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone. Use at least 2 gallons of spray volume per 1000 ft<sup>2</sup>; OR apply .75–1.5 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench; OR mix 13 fluid ounces (385 ml) in the appropriate amount of water for drenching containers of different sizes (see label).

## Marathon® II – Systemic and Translaminar Insecticide

Apply 1.7 fluid ounces (50 ml) per 100 gallons as a foliar spray; OR mix 1.7 fluid ounces in the appropriate amount of water for drenching containers of different sizes (see label); OR apply 0.1–0.2 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench. Shake well before using.

## Marathon® 60WP in WSP – Systemic and Translaminar Insecticide

Mix one 20 gram packet per 100 gallons as a foliar spray; OR mix one 20-gram packet in the appropriate amount of water for drenching containers of different sizes (see label) OR apply one 20 gram packet per 8 to 16 inches of cumulative trunk diameter (at breast height) or per 8 to 16 feet of cumulative shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench.

## Marathon® 1% G – Systemic Insecticide

Marathon® 1% Granular systemic insecticide is applied topically to the growing media or incorporated prior to planting. See label for application rates for different container sizes; OR Apply 15 ounces per 1000 ft<sup>2</sup>.

## Azatin® XL – Insect Growth Regulator

Apply 10 to 16 fluid ounces per 100 gallons to target leafminer larvae. Tank mix with Decathlon 20WP to target both adults and larvae. The pH of the spray solution should be maintained between 3 and 7. For best results use a spray adjuvant. Repeat applications at 5 to 7 day intervals.

## Decathlon® 20 WP – Synthetic Pyrethroid

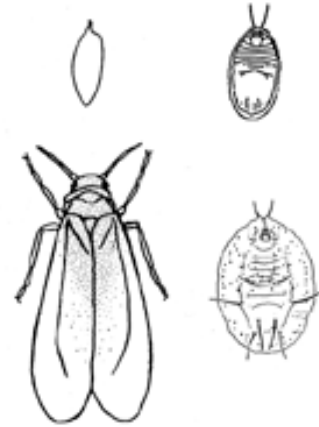
Apply 1.9 ounces (54 grams) per 100 gallons as a foliar spray. Tank mix with Azatin XL to target larvae and adults. Repeat at 5 to 7 day intervals.

# Whitefly

Order Homoptera, Family Aleyrodidae

Whiteflies are sucking insects as adults and nymphs. Their presence detracts from plants' value, and high numbers can reduce plant growth or vegetable yields. Silverleaf whiteflies can cause leaf spotting, white stem and bract deformation on poinsettia. Honeydew from whiteflies makes leaves and fruits sticky and is a substrate for black sooty fungus. Whiteflies can transmit many plant viruses affecting vegetable and ornamental plants.

The developmental stages are egg, nymph, (three instars), pupa, and adult. Greenhouse whiteflies develop from egg to adult in 21 to 26 days (81°F, 27°C) and silverleaf whiteflies in 16 days (86°F, 30°C) to 31 days (68°F, 20°C). All stages normally occur on undersides of leaves. Infestations are localized at first, spreading to all areas later.



## Discus™ – Nursery Insecticide

Apply 25 fluid ounces per 100 gallons as a foliar spray; OR apply 3.4 to 5.6 fluid ounces per 1000 ft<sup>2</sup> as a spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone. Use at least 2 gallons of spray volume per 1000 ft<sup>2</sup>; OR apply .75–1.5 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench; OR mix 13 fluid ounces (385 ml) in the appropriate amount of water for drenching containers of different sizes (see label).

## Marathon® II – Systemic and Translaminar Insecticide

Apply 1.7 fluid ounces (50 ml) per 100 gallons as a foliar spray; OR mix 1.7 fluid ounces in the appropriate amount of water for drenching containers of different sizes (see label); OR apply 0.1–0.2 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench. Shake well before use.

## Marathon® 60WP in WSP – Systemic and Translaminar Insecticide

Mix one 20 gram packet per 100 gallons as a foliar spray; OR mix one 20-gram packet in the appropriate amount of water for drenching containers of different sizes (see label) OR apply one 20 gram packet per 8 to 16 inches of cumulative trunk diameter (at breast height) or per 8 to 16 feet of cumulative shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench.

## Marathon® 1% G – Systemic Insecticide

Marathon® 1% Granular systemic insecticide is applied topically to the growing media or incorporated prior to planting. See label for application rates for different container sizes; OR Apply 15 ounces per 1000 ft<sup>2</sup>.

## Judo™ – Greenhouse and Nursery Ornamental Miticide/Insecticide

Apply 2 to 4 fluid ounces per 100 gallons to developing whitefly infestations. Do not apply Judo more than 3 times per season.

## Azatin® XL – Insect Growth Regulator

Apply 10 to 16 fluid ounces per 100 gallons to target whitefly nymphs. Tank mix with Decathlon 20WP to target both nymphs and adults. The pH of the spray solution should be maintained between 3 and 7. For best results use a spray adjuvant. Repeat applications at 5 to 7 day intervals.

## Decathlon® 20 WP – Synthetic Pyrethroid

Apply 1.9 ounces (54 grams) per 100 gallons to target whitefly adults. Tank mix with Azatin XL insect growth regulator to target both adults and nymphs. Repeat at 5 to 7 day intervals.

## Triact® 70 – Clarified Hydrophobic Extract of Neem Oil

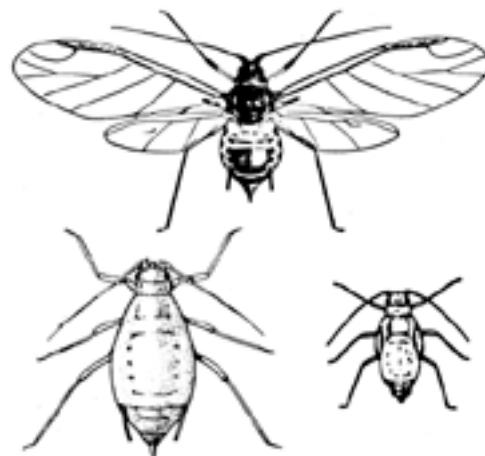
Mix 1–2 gallons per 100 gallons and apply as a foliar spray. Repeat applications at 7–14 day intervals as required.

# Aphids

*Order Homoptera, Family Aphididae*

Aphids are sucking insects that feed on plant fluids. The presence of aphids or white cast-off skins on leaves or flowers may reduce plants value. Heavy infestations will reduce plant growth. Honeydew produced by aphids makes leaves and fruits sticky and is a substrate for black sooty fungus. Many aphid species transmit viruses affecting vegetable and ornamental plants.

Aphid developmental stages are egg, nymph and adult. In tropical areas adults are all females that produce live young. Outdoors in temperate areas aphids overwinter as eggs, which hatch in the spring as females. Adult aphids may or may not have wings. The best temperatures for development vary with the species. For example the chrysanthemum aphid develops best at 68°F(20°C), the green peach aphid at 73°F(23°C), and the melon aphid at temperatures above 75°F(24°C). Plant nutrition affects aphid development and size. Moisture stress often increases aphid numbers. Temperatures above 86°F(30°C) and relative humidity above 85% reduce green peach aphid longevity and reproduction.



## Discus™ – Nursery Insecticide

Apply 25 fluid ounces per 100 gallons as a foliar spray; OR apply 3.4 to 5.6 fluid ounces per 1000 ft<sup>2</sup> as a spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone. Use at least 2 gallons of spray volume per 1000 ft<sup>2</sup>; OR apply .75–1.5 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench; OR mix 13 fluid ounces (385 ml) in the appropriate amount of water for drenching containers of different sizes (see label).

## Marathon® II – Systemic and Translaminar Insecticide

Apply 1.7 fluid ounces (50 ml) per 100 gallons as a foliar spray; OR mix 1.7 fluid ounces in the appropriate amount of water for drenching containers of different sizes (see label); OR apply 0.1–0.2 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench. Shake well before use.

## Marathon® 60WP in WSP – Systemic and Translaminar Insecticide

Mix one 20 gram packet per 100 gallons as a foliar spray; OR mix one 20-gram packet in the appropriate amount of water for drenching containers of different sizes (see label) OR apply one 20 gram packet per 8 to 16 inches of cumulative trunk diameter (at breast height) or per 8 to 16 feet of cumulative shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench.

## Marathon® 1% G – Systemic Insecticide

Marathon® 1% Granular systemic insecticide is applied topically to the growing media or incorporated prior to planting. See label for application rates for different container sizes; OR Apply 15 ounces per 1000 ft<sup>2</sup>.

## Azatin® XL – Insect Growth Regulator

Apply 10 to 16 fluid ounces per 100 gallons to target aphid nymphs. Tank mix with Decathlon 20WP to target adults and improve control of nymphs. The pH of the spray solution should be maintained between 3 and 7. For best results use a spray adjuvant. Repeat applications at 5 to 7 day intervals.

## Decathlon® 20 WP – Synthetic Pyrethroid

Apply 1.9 ounces (54 grams) per 100 gallons to target aphid adults and nymphs. Tank mix with Azatin XL insect growth regulator to improve control of nymphs. Repeat at 5 to 7 day intervals.

## Triact® 70 – Clarified Hydrophobic Extract of Neem Oil

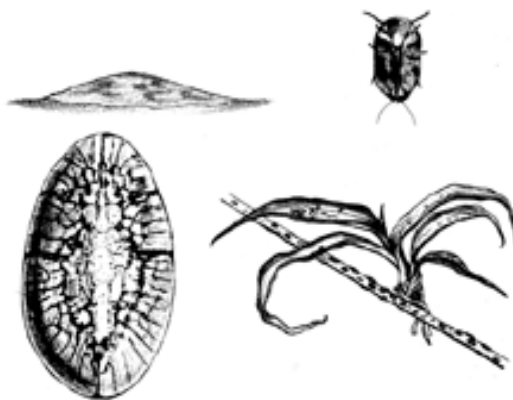
Mix 1–2 gallons per 100 gallons and apply as a foliar spray. Repeat applications at 7–14 day intervals as required.

# Soft and Armored Scales

*Soft Scales, Order Homoptera, Family Diaspididae / Armored Scales, Order Homoptera, Family Diaspididae*

Soft and armored scale insects are sucking pests that feed on plant fluids. Feeding weakens and may kill plants. Honeydew produced by soft scales can cover leaves and flowers, and is a substrate for black sooty fungus. Armored scales do not produce honeydew.

Soft and armored scale developmental stages are egg (or live nymph), nymph (females, three instars; males, five instars), and adult. Adult males are totally different looking than females, resembling small midge-like insects. Females of some species reproduce without mating (parthenogenesis). Soft scale development from egg to adult is about 60 days, and armored scale development is about 180 days, but varies widely with individual species.



## Discus™ – Nursery Insecticide

Apply 25 fluid ounces per 100 gallons as a foliar spray; OR apply 3.4 to 5.6 fluid ounces per 1000 ft<sup>2</sup> as a spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone. Use at least 2 gallons of spray volume per 1000 ft<sup>2</sup>; OR apply .75–1.5 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench; OR mix 13 fluid ounces (385 ml) in the appropriate amount of water for drenching containers of different sizes (see label).

## Marathon® II – Systemic and Translaminar Insecticide

Apply 1.7 fluid ounces (50 ml) per 100 gallons as a foliar spray; OR mix 1.7 fluid ounces in the appropriate amount of water for drenching containers of different sizes (see label); OR apply 0.1–0.2 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench. Shake well before use. *The addition of a surfactant to the spray mixture may improve control.*

## Marathon® 60WP in WSP – Systemic and Translaminar Insecticide

Mix one 20 gram packet per 100 gallons as a foliar spray; OR mix one 20-gram packet in the appropriate amount of water for drenching containers of different sizes (see label) OR apply one 20 gram packet per 8 to 16 inches of cumulative trunk diameter (at breast height) or per 8 to 16 feet of cumulative shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench.



## Marathon® 1% G – Systemic Insecticide

Marathon® 1% Granular systemic insecticide is applied topically to the growing media or incorporated prior to planting. See label for application rates for different container sizes; OR Apply 15 ounces per 1000 ft<sup>2</sup>.

## Azatin® XL – Insect Growth Regulator

Apply 10 to 16 fluid ounces per 100 gallons to target nymphs. Tank mix with Decathlon 20WP to improve control. The pH of the spray solution should be maintained between 3 and 7. For best results use a spray adjuvant. Repeat applications at 5 to 7 day intervals.

## Triact® 70 – Clarified Hydrophobic Extract of Neem Oil

Apply 1 to 2 gallons per 100 gallons. Repeat at 7 to 10 day intervals depending on the severity of the infestation.

## Decathlon® 20 WP – Synthetic Pyrethroid

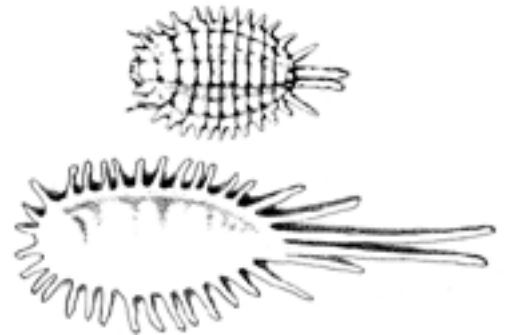
Apply 1.9 ounces (54 grams) per 100 gallons. Tank mix with Azatin XL insect growth regulator to improve control. Repeat at 5 to 7 day intervals.

# Mealybugs

*Order Homoptera, Family Pseudococcidae*

Mealybugs are sucking insects that feed on plant fluids. Feeding weakens and may kill plants. Honeydew produced by mealybugs can cover leaves and flowers, and is a substrate for black sooty fungus.

Mealybug developmental stages are egg, nymph (females, four instars; males, five instars), and adult. Egg to adult development takes about 60 days, but varies widely with individual species. It may take up to one year in cool temperatures. Adult males are totally different looking than females, resembling small midge-like insects.



## Discus™ – Nursery Insecticide

Apply 25 fluid ounces per 100 gallons as a foliar spray; OR apply 3.4 to 5.6 fluid ounces per 1000 ft<sup>2</sup> as a spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone. Use at least 2 gallons of spray volume per 1000 ft<sup>2</sup>; OR apply .75–1.5 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench; OR mix 13 fluid ounces (385 ml) in the appropriate amount of water for drenching containers of different sizes (see label).

The addition of a surfactant to the spray mixture may improve control.

## Marathon® II – Systemic and Translaminar Insecticide

Apply 1.7 fluid ounces (50 ml) per 100 gallons as a foliar spray; OR mix 1.7 fluid ounces in the appropriate amount of water for drenching containers of different sizes (see label); OR apply 0.1–0.2 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench. Shake well before use. The addition of a surfactant to the spray mixture may improve control.

## Marathon® 60WP in WSP – Systemic and Translaminar Insecticide

Mix one 20 gram packet per 100 gallons as a foliar spray; OR mix one 20-gram packet in the appropriate amount of water for drenching containers of different sizes (see label) OR apply one 20 gram packet per 8 to 16 inches of cumulative trunk diameter (at breast height) or per 8 to 16 feet of cumulative shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench.

## Marathon® 1% G – Systemic Insecticide

Marathon® 1% Granular systemic insecticide is applied topically to the growing media or incorporated prior to planting. See label for application rates for different container sizes; OR Apply 15 ounces per 1000 ft<sup>2</sup>.

## Azatin® XL – Insect Growth Regulator

Apply 10 to 16 fluid ounces per 100 gallons. Tank mix with Decathlon 20WP to improve control. The pH of the spray solution should be maintained between 3 and 7. For best results use a spray adjuvant. Repeat applications at 5 to 7 day intervals.

## Triact® 70 – Clarified Hydrophobic Extract of Neem Oil

Apply 1 to 2 gallons as a foliar spray. Repeat applications at 7 to 10 day intervals depending on the severity of infestation.

## Decathlon® 20 WP – Synthetic Pyrethroid

Apply 1.9 ounces (54 grams) per 100 gallons. Tank mix with Azatin XL insect growth regulator to improve control. Repeat applications at 5 to 7 day intervals.

# Root Mealybugs

*Order Homoptera, Family Pseudococcidae*

Root mealybugs are in the Genus *Rhizoecus*. They are sucking pests similar to other mealybugs that feed on stems and leaves, but are adapted to feed on plant roots. Adults resemble small insects that have been rolled in white flour. Adults and their cottony egg masses are usually on the outside of the root ball, and can be seen when the plant is lifted from the container.



Damage symptoms are non-specific and usually involve slow or stunted plant growth, resulting in generally unhealthy looking plants. Plants that are root bound or under environmental or nutritional stress seem to be more susceptible to root mealybugs.

Females (there are no males) lay eggs in cottony masses, which hatch into tiny crawlers. The crawler stage is the most important for root mealybug dispersal among plants – often in irrigation water, but also in potting media. The initial infestation is often from purchasing infested plants. The life cycle from egg to adult is from 2–4 months. Adults can live nearly 60 days and produce three batches of eggs.

**Note:** *The application of a soil wetting agent such as Suffusion several days before the drench may improve root mealybug control.*

## Discus™ – Nursery Insecticide

Apply 13 fluid ounces in 150 gallons of water as a drench to container-grown plants. The drench must be thorough, but leaching should be minimal.

## Marathon® II – Systemic and Translaminar Insecticide

Apply 1.7 fluid ounces (50 ml) in 150 gallons of water as a drench to container-grown plants. The drench must be thorough, but leaching should be minimal. Shake well before use.

## Marathon® 60WP in WSP – Systemic and Translaminar Insecticide

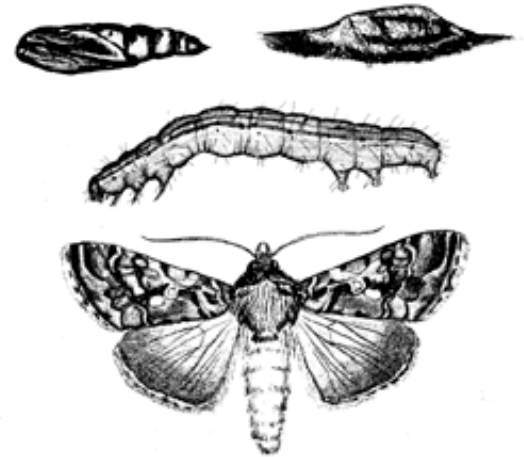
Apply one 20 gram packet in 150 gallons of water as a drench to container-grown plants. The drench must be thorough, but leaching should be minimal.

# Caterpillars (Worms)

Order Lepidoptera, Several families such as Noctuidae, Tortricidae, Pyralidae, Arctiidae

Plant injury is caused only by the larval (worm) stages. Larvae are chewing insects and can eat entire leaves and flowers, bore into stems and roll/tie leaves. Nearly all parts of the plant can be infested. Cutworm larvae may be in the growing media or beneath pots.

Lepidoptera developmental stages are egg, larva (number of instars depends on the species), pupa, adult (moth). Development from egg to adult is about 30 days, but varies depending upon the species and temperature. Plants high in nitrogen may be more heavily damaged.



## Discus™ – Nursery Insecticide

Apply 50 fluid ounces per 100 gallons as a foliar spray.

## Azatin® XL – Insect Growth Regulator

Apply 10 to 16 fluid ounces per 100 gallons to target the larvae. Tank mix with Decathlon 20WP to improve larval control and target adults. The pH of the spray solution should be maintained between 3 and 7. For best results use a spray adjuvant. Repeat applications at 5 to 7 day intervals.

## Decathlon® 20 WP – Synthetic Pyrethroid

Apply 1.9 ounces (54 grams) per 100 gallons to target larvae and adults. Tank mix with Azatin XL insect growth regulator to improve larval control. Repeat applications at 5 to 7 day intervals.

## Deliver® – Biological Insecticide

Apply 0.25 – 1.5 pounds per 100 gallons as a foliar spray. Apply when most larvae are in the 3rd–4th instar. Repeat in 14 days if necessary.

# Lace Bugs

Order Hemiptera, Family Tingidae

Lace bugs are sucking insects that feed on plant fluids. Feeding injury causes yellow spotting on leaves, which may turn brown and fall off the plants.

Lace bug developmental stages are egg, nymph (five instars) and adult. Development time varies with species and geographic location. There are multiple generations per year. Nymphs have spine-like projections on their bodies. Adults have wings with very elaborate designs on them. Depending on the species Lace bugs overwinter as eggs or adults, and become active in the spring.



## Discus™ – Nursery Insecticide

Apply 25 fluid ounces per 100 gallons as a foliar spray; OR apply 3.4 to 5.6 fluid ounces per 1000 ft<sup>2</sup> as a spray to the soil surface, followed by irrigation or rainfall to move the active ingredient to the root zone. Use at least 2 gallons of spray volume per 1000 ft<sup>2</sup>; OR apply .75–1.5 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench; OR mix 13 fluid ounces (385 ml) in the appropriate amount of water for drenching containers of different sizes (see label).

## Marathon® II – Systemic and Translaminar Insecticide

Apply 1.7 fluid ounces (50 ml) per 100 gallons as a foliar spray; OR mix 1.7 fluid ounces in the appropriate amount of water for drenching containers of different sizes (see label); OR apply 0.1–0.2 fluid ounces per inch of trunk diameter (at breast height) or per foot of shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench. Shake well before use.

## Marathon® 60WP in WSP – Systemic and Translaminar Insecticide

Mix one 20 gram packet per 100 gallons as a foliar spray; OR mix one 20-gram packet in the appropriate amount of water for drenching containers of different sizes (see label) OR apply one 20 gram packet per 8 to 16 inches of cumulative trunk diameter (at breast height) or per 8 to 16 feet of cumulative shrub height. Use a minimum of 10 gallons of water per 1000 ft<sup>2</sup> as a drench.

## Marathon® 1% G – Systemic Insecticide

Marathon® 1% Granular systemic insecticide is applied topically to the growing media or incorporated prior to planting. See label for application rates for different container sizes; OR Apply 15 ounces per 1000 ft<sup>2</sup>.

## Decathlon® 20 WP – Synthetic Pyrethroid

Apply 1.9 ounces (54 grams) per 100 gallons. Repeat applications at 5 to 7 day intervals.

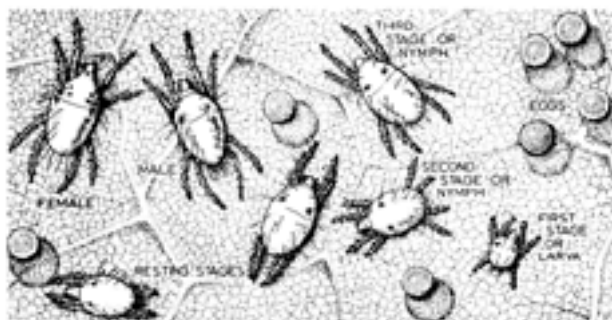
# Spider Mites

*Order Acari, Family Tetranychidae*

There are numerous pest species of spider mites that can occur on nursery ornamentals. These include the two-spotted spider mite, spruce spider mite, boxwood spider mite, maple spider mite, honeylocust spider mite and southern red mite.

Spider mites have rasping–sucking mouthparts. Feeding damage appears as light-colored spots, or stipples on upper leaf surfaces. Most spider mite species produce silk-like webbing. Heavy infestations can kill plants or cause leaves to drop off, and webbing can cover leaves and flowers resulting in aesthetic injury.

Spider mite developmental stages are egg, larva, protonymph, deutonymph, and adult. Development time varies with temperature. For example the two-spotted spider mite - a warm season mite - development from egg to adult takes about 8 days (77°–95°F, 25°–35°C) to 28 days (50°–68°F, 10°–20°C). Hot and dry conditions are most favorable. The spruce spider mite - a cool season mite - does best during the spring and fall months. Development time ranges from 11 to 24 days, quite fast even at cooler temperatures. When temperatures reach the upper 80's or 90's °F, spruce spider mite development generally stops and "over-summering" eggs are produced to await cooler fall temperatures. Spider mite development is affected by the host plant, plant nutrition, leaf age, and moisture stress. Moisture stressed plants often have higher spider mite populations. High moisture slows mite dispersal. Spider mites are usually on undersides of leaves, but may be on/in flowers in heavy infestations.



## Judo™ – Greenhouse and Nursery Ornamental Miticide/Insecticide

Apply 1 to 4 fluid ounces per 100 gallons to developing mite populations. Do not make more than 4 applications per season.

## Triact® 70 – Clarified Hydrophobic Extract of Neem Oil

Mix 1–2 gallons per 100 gallons and apply as a foliar spray. Repeat applications at 7–14 day intervals as required.

Avoid applications at temperatures exceeding 90°F. Always read the label.

# Mites other than Spider Mites

*Order Acari*

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Many other mite species can occur and damage nursery ornamentals, including the following families:

Tenuipalpid mites (Family Tenuipalpidae). Also known as false spider mites or flat mites, this group includes two common species, the privet mite (also called the ornamental flat mite) and the Pacific flat mite - a serious pest of orchids.

Tarsonemid mites (Family Tarsonemidae). Also known as thread footed mites, the two most well known species are the broad mite and cyclamen mite.

Rust and Blister mites (Family Eriophyidae). These tiny microscopic mites cannot be seen without magnification, but the leaf blisters and rusty-appearing foliage they cause indicate an infestation.

## Judo™ – Greenhouse and Nursery Ornamental Miticide/Insecticide

Apply 1 to 4 fluid ounces per 100 gallons to developing mite populations. Do not make more than 4 applications per season.

## Triact® 70 – Clarified Hydrophobic Extract of Neem Oil

Mix 1–2 gallons per 100 gallons and apply as a foliar spray. Repeat applications at 7–14 day intervals as required.

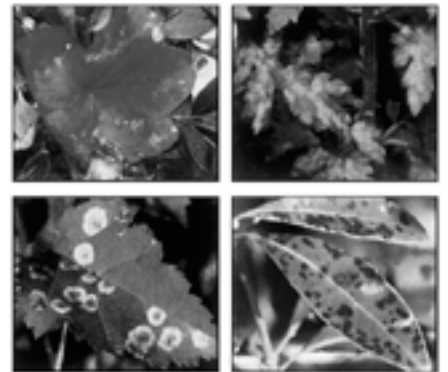
Avoid applications at temperatures exceeding 90°F. Always read the label.

# Foliar Diseases

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**Botrytis blight or gray mold** can develop on any above ground plant part. Favorable conditions for Botrytis development are cool wet weather, high humidity (85%+), plant crowding and poor sanitation. Affected areas are tan, brown or gray dead spots with the fungus often forming fuzzy masses of spores. Spores are called conidia and are released with watering or simply by taking cuttings. These spores move in the air and infect other plants when conditions are right.

To control Botrytis, avoid long periods of leaf wetness. This is a key to avoiding most of the foliar diseases. Botrytis can occur all year round but can be a real problem in late winter on many covered nursery crops. Disease problems can be reduced by modifying irrigation, increasing air movement by modifying plant spacing to reduce humidity. Sanitation is also critical. Remove all dead and dying plant tissues from the area prior to starting another crop.



Fungicides for control:

## OHP 26 GT®-O or Sextant™ or OHP Chipco® 26019 N/G – Fungicide

Apply 1–2.5 quarts per 100 gallons as a foliar spray (OHP 26 GT-O or Sextant);  
Apply 1–2 lbs per 100 gallons as a foliar spray (OHP Chipco 26019 N/G).

## Compass® O 50 WDG – Strobilurin Fungicide

Apply 2–4 ounces per 100 gallons as a foliar spray.

## **OHP 6672™ 4.5L or OHP 6672™ 50W – Ornamental Fungicide**

Apply 10 fluid ounces per 100 gallons as a foliar spray (OHP 6672 4.5L);  
Apply 12 – 16 ounces per 100 gallons as a foliar spray (OHP 6672 50W).

## **Triact® 70 – Clarified Hydrophobic Extract of Neem Oil**

Apply 0.5 to 1 gallon per 100 gallons as a foliar spray

**Powdery mildews** are fungal pathogens that will form a white powdery growth on the surface of plant parts. This white powdery fungal growth can be found on the flowers, leaves and stems of many plants. Young foliage is more often the site of infection, rather than older tissue. Alternating periods of leaf wetness followed by warmer and drier conditions will promote powdery mildew development. Different species of powdery mildew generally infect different host plants, although some species have a large host range.

Powdery mildew management can be improved by providing good sanitation, and by increasing plant spacing to increase air movement and minimize leaf wetness.

Fungicides for control:

## **Strike® 50 WDG – Greenhouse and Nursery Systemic Fungicide**

Summer, apply 2 ounces per 100 gallons as a foliar spray.  
Winter, apply 1 ounce per 100 gallons as a foliar spray.

## **Compass® O 50 WDG – Strobilurin Fungicide**

Apply 1–2 ounces per 100 gallons as a foliar spray.

## **OHP 6672™ 4.5L or OHP 6672™ 50W – Ornamental Fungicide**

Apply 10 fluid ounces per 100 gallons as a foliar spray (OHP 6672 4.5L);  
Apply 12 – 16 ounces per 100 gallons as a foliar spray (OHP 6672 50W).

## **Triact® 70 – Clarified Hydrophobic Extract of Neem Oil**

Apply 0.5 to 1 gallon per 100 gallons as a foliar spray.

**Rust diseases** are highly specialized fungi and can only infect closely related plants. Some rust pathogens require a second host for a complete life cycle. Ornamental plants susceptible to rust diseases include carnation, rose, snapdragon, geranium, Hy-pericum, sunflower and salvia. Leaf wetness encourages rust spore germination. Spores spread by splashing water and through air movement. Symptoms appear as orange–yellow to rusty–red colored leaf spots made up of rust pustules, generally on the lower leaf surface.

To help control rust diseases, water plants only when leaves will dry quickly. Remove infected leaves or entire plants from the nursery.

Fungicides for control:

### **Compass® O 50 WDG – Strobilurin Fungicide**

Apply 2–4 ounces per 100 gallons as a foliar spray.

### **Strike® 50 WDG – Greenhouse and Nursery Systemic Fungicide**

Summer, apply 2 ounces per 100 gallons as a foliar spray.  
Winter, apply 1 ounce per 100 gallons as a foliar spray.

### **Triact® 70 – Clarified Hydrophobic Extract of Neem Oil**

Apply 0.5 to 1 gallon per 100 gallons as a foliar spray.

**Fungal leaf spots and blights** include Alternaria, Septoria, Didymellina and Colletotrichum (Botrytis as well). Symptoms often appear as necrotic spots and dead areas on leaves and stems. Fungal leaf spots are typically round to angular with tan to gray centers and dark colored borders (black, brown or purple). Some spots may have yellow or reddish halos surrounding the spots. Leaf wetness, plant crowding and poor air circulation will encourage infections of fungal leaf spots.

Cultural controls include inspecting plants upon arrival and discarding any with symptoms. Remove infected plant material and plant debris from the production area. Increasing plant spacing improves air circulation around the plants, reduces humidity levels and aids in plant drying. Avoid prolonged periods of leaf wetness by watering early in the day.

Fungicides for control:

### **OHP 26 GT®-O or Sextant™ or OHP Chipco® 26019 N/G – Fungicide**

Apply 1–2.5 quarts per 100 gallons as a foliar spray (OHP 26 GT-O or Sextant);  
Apply 1–2 lbs per 100 gallons as a foliar spray (OHP Chipco 26019 N/G).

### **Compass® O 50 WDG – Strobilurin Fungicide**

Apply 2–4 ounces per 100 gallons as a foliar spray.

### **OHP 6672™ 4.5L or OHP 6672™ 50W – Ornamental Fungicide**

Apply 10 fluid ounces per 100 gallons as a foliar spray (OHP 6672 4.5L);  
Apply 12 – 16 ounces per 100 gallons as a foliar spray (OHP 6672 50W).

**Downy mildews** (*Peronospora spp.*, *Plasmopara spp.*, *Basidophora*, *Bremia*, *Bremiella*.) can become active with cool temperatures, wet conditions and high humidity. Downy mildews are in the same pathogen class as Pythium and Phytophthora (water molds). Symptoms are not always easy to recognize and may appear as other plant problems. There may be microscopic sporangia (spore sacs) on the bottom of the leaf with a darker blotch on the upper surface. Some downy mildews are more aggressive than others. The fungus grows within the plant tissue and not on the surface and symptoms may not appear until conditions are perfect for spore formation, when they emerge on the underside of the leaf. On some plants, symptoms include distortion, stunting and curling of new leaves that appears much like damage from aphids.

To control downy mildews it is important to remove and dispose of any diseased plant tissue. Control is difficult and most fungicides only offer protection.

Fungicides for control:

### **OHP Aliette® WDG – Fungicide**

Apply 1.25–5 pounds per 100 gallons as a foliar spray.

### **Compass® O 50 WDG – Strobilurin Fungicide**

Apply 1–2 ounces per 100 gallons as a foliar spray.

### **Triact® 70 – Clarified Hydrophobic Extract of Neem Oil**

Apply 0.5 to 1 gallon per 100 gallons as a foliar spray.

## **Damping–Off and Related Root Rots**

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Damping off can destroy seeds and young seedlings through infection by soil borne pathogens. Pre–emergence damping–off occurs when germinating seeds are attacked and rot before they emerge from the soil. Post emergence damping–off occurs when newly emerged seedlings wilt or collapse. Stems often have necrotic or water–soaked lesions at the soil interface. A pattern of collapsed plants appears as the fungus move out from the area of initial infection.

Several pathogens can cause these diseases, including the water molds (more closely related to algae than fungi) Phytophthora, and Pythium. Root rots are also caused by the true fungi, including Fusarium, Rhizoctonia, Thielaviopsis and Cylindrocladium. It is important to identify the pathogen(s) causing the disease (e.g. Pythium, Phytophthora or one of the true fungi) because the fungicides used for control are different. Many diseases can be caused or spread by an increase of circulated water, sub–irrigation (ebb and flood) systems and over fertilization.

### **Root Rots caused by Water Molds**

Phytophthora root rot infections appear to be lacking water because the pathogen is destroying the plants' water conducting ability. Phytophthora diseases affect both woody and herbaceous plants. Spores can remain dormant for a long time just waiting for conditions to be right.

Fungicides for control:

### **OHP Aliette® WDG – Fungicide**

Apply 6.4–12.8 ounces per 100 gallons as a drench at 1–2 pints per square foot.

### **Compass® O 50 WDG – Strobilurin Fungicide**

Apply 1 – 2 ounces per 100 gallons as a drench to wet the upper one–half of the container media.



## Damping Off and Root Rots caused by True Fungi

Rhizoctonia stem and root rot diseases are caused by soil borne fungal pathogens. Rhizoctonia can be especially damaging to seedlings causing damping off. Cankers and moist lesions form at the base of infected petioles at the soil interface or on the stems. Rhizoctonia is most severe with high temperatures and moist conditions.

Fungicides for control:

### Compass® O 50 WDG – Strobilurin Fungicide

Apply 0.5 ounce per 100 gallons as a drench to wet the upper one-half of the container media.

### OHP 26 GT®-O or Sextant™ or OHP Chipco® 26019 N/G – Fungicide

OHP 26 GT-O or Sextant, apply 13 fluid ounces per 100 gallons as a drench at 1–2 pints per square foot.

OHP Chipco 26019 N/G, apply 6.5 ounces per 100 gallons as a drench at 1–2 pints per square foot.

### OHP 6672™ 4.5L or OHP 6672™ 50W – Ornamental Fungicide

OHP 6672 50W, apply 12–16 ounces per 100 gallons at 1–3 pints per square foot.

OHP 6672 4.5L, apply 20 fluid ounces per 100 gallons at 1–2 pints per square foot.

### SoilGard® 12G – Microbial Fungicide

Mix 1 – 1.5 pounds per cubic yard of container media and incorporate; OR add 0.5 – 2 pounds to 100 gallons of water and drench at 100 gallons per 400 square feet.

**Thielaviopsis** is another soil borne fungal pathogen. Symptoms can include chlorotic foliage and stunted growth above-ground and the typical decayed roots that exhibit a black or very dark appearance (black root rot). Thielaviopsis can produce basal lesions (generally not as wet as Rhizoctonia). This disease is problematic with plant stress including high pH, cool soil, poor drainage and excess fertilization.

Fungicides for control:

### Compass® O 50 WDG – Strobilurin Fungicide

Apply 1 – 2 ounces per 100 gallons as a drench to wet the upper one-half of the container media.

### OHP 6672™ 4.5L or OHP 6672™ 50W – Ornamental Fungicide

OHP 6672 50W, apply 12–16 ounces per 100 gallons at 1–3 pints per square foot.

OHP 6672 4.5L, apply 20 fluid ounces per 100 gallons at 1–2 pints per square foot.

# Weed Management

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## **Ronstar® 50WSP – Preemergent Herbicide**

Apply 4–8 water soluble packets per acre in a minimum of 50 gallons of water. Ronstar 50WSP may be used as an over the top spray on certain woody field and container–grown plants. See the label for details.

## **Ronstar® G – Preemergent Herbicide**

Apply 100 – 200 pounds per acre (2.25 – 4.5 pounds per 1000 ft<sup>2</sup>). Remove existing weeds before application.

# Soil Media Wetting Agent and Moisture Management

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## **Suffusion™ Liquid – Alkoxyether Surfactants**

For Soil Applications in Greenhouse, Nursery and Interiorscapes  
Rate: Varies – 2.0 – 15.0 fluid ounces per 100 gallons – Refer to label.

## **Suffusion™ Granules – Alkoxyether Surfactants**

For Soil Applications in Greenhouse, Nursery and Interiorscapes  
Rate: Varies – 0.5 – 2.0 Pounds per Cubic Yard of Soil Media – Refer to label.

## **Suffusion™ Tablets – Polyhydroxyethyl Alkoxy Alkylene Oxides**

For application to potting media prior to shipping and/or while at retail outlets.  
Applications made through specialized applicators. Refer to label.

## SMALL VOLUME APPLICATION RATES FOR OHP, Inc. PRODUCTS

Fungicides	Rate per gallon (tsp or gm/ml)	Rate per 100 gallons
OHP Aliette®	1 1/4 - 4 4/5 tsp., 5.7 - 22.7 gm.	1 1/4 - 5 lbs.
OHP Chipco® 26019 N/G	1 1/3 - 2 2/3 tsp., 4.5 - 9 gm.	1 - 2 lbs.
OHP 26 GT®-O or Sextant™	1 3/4 - 4 1/2 tsp., 9 - 23 ml.	1 - 2.5 qts.
Compass® O	1/10 - 1/3 tsp., 0.3 - 1.1 gm.	1 - 4 oz.
OHP 6672™ 50WP	1 2/3 - 5 tsp., 2.3 - 6.8 gm.	8 - 24 oz.
OHP 6672™ 4.5L	1 1/5 tsp., 5.9 ml.	20 fl. oz.
SoilGard®	1 1/2 - 2 tsp., 2.3 - 9 gm.	1/2 - 2 lbs.
Strike® 50 WDG	1/10 - 1/5 tsp., 0.3 - 0.6 gm.	1 - 2 oz.
Triact® 70	3 3/4 - 7 1/2 tsp., 19 - 38 ml.	0.5 - 2 gal.

Insecticides/Miticides	Rate per gallon (tsp or gm/ml)	Rate per 100 gallons
Azatin® XL	1/3 - 1 tsp., 1.5 - 5 ml.	5 - 16 fl. oz.
Decathlon®	1/5 - 1/4 tsp., 0.4 - 0.5 gm.	1.3 - 1.9 oz.
Deliver®	1/4 - 1 1/4 tsp., 1.2 - 5.7 gm.	1/4 - 1 1/4 lbs.
Discus™	1 1/2 - 3 tsp., 7.5 - 15 ml.	25 - 50 fl. oz.
Judo™	1/10 - 1/5 tsp., 0.5 - 1.2 ml.	2 - 4 fl. oz.
Marathon® II	1/10 tsp., 0.5 ml.	1.7 fl. oz., 50 ml.
Triact® 70	3 3/4 - 7 1/2 tsp., 19 - 38 ml.	0.5 - 2 gal.

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## Notes

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