

OHP Insect Solutions™



Diagnosis: APHIDS

Solutions: CUSTOM-DESIGNED FOR THE GROWER



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| <input type="checkbox"/> Adept® | <input checked="" type="checkbox"/> Marathon® 60 WP |
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| <input checked="" type="checkbox"/> Decathlon® | <input checked="" type="checkbox"/> Naturalis® L |
| <input checked="" type="checkbox"/> Discus® N/G | <input type="checkbox"/> Pedestal™ |
| <input type="checkbox"/> Floramite® SC | <input type="checkbox"/> Shuttle™ O |
| <input type="checkbox"/> Judo™ | <input type="checkbox"/> Sirocco™ |
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USE APPLICATION RATES
AS DIRECTED - SEE CHART.
- OHP REP



Greenhouse and Nursery PESTS

Aphids

Order Hemiptera, Family Aphididae



Adult aphid and nymph Adult winged aphid Aphids and white cast-off skins

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 greenhouses and tropical areas, adults are all females that produce live young. Outdoors, 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 humidities above 85% reduce green peach aphid longevity and reproduction.

Caterpillars (worms)

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



Adult beet armyworm Beet armyworm larva Cabbage looper larva

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.

Fungus Gnats

Order Diptera, Family Sciaridae



Fungus gnat adult female Fungus gnat larvae



Poinsettias with roots damaged by fungus gnat larvae

Fungus gnat adults are small midge-like flies that cause no direct plant damage. However, the larvae can feed on roots or root hairs, stunting or killing young plants. Fungus gnats have been associated with several plant pathogens. Larval feeding damage may provide an entry point for plant pathogens.

Fungus gnat developmental stages are egg, larva (four instars), pupa, adult. Development from egg to adult takes about 12 days (80°F, 27°C) to 27 days (55°F, 13°C). High growing medium moisture and organic matter (composted manure, bark, leaf litter) are most favorable for fungus gnats. Adults are usually seen near the growing medium surface, but may be seen resting on plants. Larvae are in the growing medium or in plant stems below the medium surface.

Shore Flies

Order Diptera, Family Ephydriidae



Shore fly adult Shore fly larvae Shore fly adult and black fecal spots on leaf

Shore fly adults are small flies that resemble fruit flies in size and shape, but have black bodies with red eyes. When at rest white spots can be seen on the wings. Both adults and larvae feed on algae, bacteria and protozoa. Direct feeding injury to plants is rare, but adults may help to spread plant pathogens.

Shore fly development stages are egg, larva, pupa and adult. Development time from egg to adult is about 10 days (93°F, 34°C) to 16 days (73°F, 23°C). Larvae and

adults are found in areas with algae – growing media surfaces, benches and floors. Adults often occur in large numbers, and will produce black fecal spots on leaves, plug tray surfaces, etc. This is unsightly at best, and the fecal spots can contain one or more plant pathogens.

Leafminers

Order Diptera, Family Agromyzidae



Leafminer adult Leafminer larva in leaf mine Leafminer adult and leaf punctures for feeding and egg laying

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 *Liriomyza trifolii* 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.

L. trifolii 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.

Mealybugs - Soft Scales - Armored Scales

Order Hemiptera, Family Pseudococcidae – Order Hemiptera, Family Coccidae – Order Hemiptera, Family Diaspididae



Citrus mealybug Soft scale female Armored scales on rose stem

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.

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.

Root Mealybugs

Order Hemiptera, Family Pseudococcidae



Root mealybugs on outside of root ball

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.

Thrips

Order Thysanoptera, Family Thripidae



Adult western flower thrips Immature western flower thrips Gerbera flower damaged by western flower thrips

Thrips feed by piercing plant tissue and sucking fluids. Feeding injury distorts and discolors leaves and flowers. Feeding on pollen by some thrips species (e.g.

western flower thrips) 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 feed on and injure leaves. The chilli thrips, a pest new to the United States, feeds only on leaves. Different species of thrips can occur and cause problems on nearly all greenhouse plants.

Thrips develop from egg to adult in 10 to 15 days (76° to 86°F, 25° to 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.

Whiteflies

Order Hemiptera, Family Aleyrodidae



Whitefly adult

Bemisia whiteflies and eggs

Poinsettia leaf with large number of immature whitefly stages

Whiteflies are sucking insects as adults and nymphs. Their presence detracts from plants' value, and high numbers can reduce plant growth or vegetable yields.

Bemisia 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.

Spider Mites

Order Acari, Family Tetranychidae



Spider mite adult female and egg

Webbing produced by heavy spider mite infestation

Spider mites have puncturing-sucking mouthparts. Feeding damage appears as light-colored spots, or stipules on upper leaf surfaces.

Spider mites also produce 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 from egg to adult takes about 8 days (77° to 95°F, 25° to 35°C) to 28 days (50° to 68°F, 10° to 20°C). Hot and dry conditions are most favorable. 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.

Tarsonemid Mites

(Broad Mite, Cyclamen Mite)

Order Acarina, Family Tarsonemidae

Feeding injury by these tiny mites causes leaf distortion, stunting, and sometimes flower bud abortion.



Broad mite

Both species have a very wide host plant range. Because these mites are so tiny, an infestation is usually recognized by the feeding injury symptoms.

Broad mites are about 0.2mm long and cyclamen mites about 0.3mm long. Both species are colorless to light brown. Broad mites are more active than cyclamen mites. Magnification is necessary to see them.

Female broad mites will lay 30 to 75 eggs and female cyclamen mites about 12 to 16. Developmental stages are egg, larva, resting pupa and adult. The development time from egg to adult ranges from one to three weeks. These mites do best in warm and humid conditions.

Flathead and Roundheaded Borers

Order Coleoptera Families Buprestidae and Cerambycidae



Flatheaded borer adult

Flatheaded borer larva

Flatheaded borer (Buprestidae) adults are usually bright colored metallic beetles just under 1 inch long. Larvae do not have legs and have obviously enlarged segment 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. Flatheaded 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.

Root Weevils

Order Coleoptera, Family Curculionidae



Black vine weevil adult



Black vine weevil larva

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.

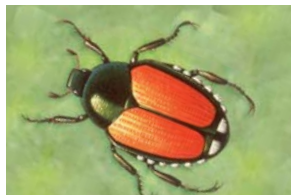
Injured plants in nurseries and greenhouses may die suddenly. Outdoors there is one generation per year. In greenhouses there may be two generations.

White Grubs

Order Coleoptera, Family Scarabaeidae



White grub larva



Japanese beetle adult

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, 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.

Leafhoppers and Sharpshooters

Order Hemiptera, Family Cicadellidae



Rose leafhopper adult



Glassywinged sharpshooter adult

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.

Plant Bugs

Order Hemiptera, Family Miridae



Four-lined plant bug Tarnished plant bug adult Plant bug feeding injury

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.

Leaf Feeding Beetles

Order Coleoptera, Family Chrysomelidae



Leaf beetle adult and feeding damage

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.

Lace Bugs

Order Hemiptera, Family Tingidae



Lace bug adult

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.

OHP *Insect Solutions*TM

OHP Representative: _____

Phone _____

E-mail _____

Grower and Location _____

INSECT / MITE PROBLEM	CROP	OHP SOLUTIONS

Date _____

Notes _____



INSECTICIDE / MITICIDE CHART

Trade Name	Adept®	Azatin®	Decathlon®	Discus® N/G	Dimilin® SC	Dimilin® 25W	Floramite®	Judo™	Kontos™	Marathon®	Naturalis®	Pedestal™	Shuttle™ O	Sirocco™	Triact® 70
Class	Benzoyl Urea IGR	BioPesticide	Pyrethroid	Pyrethroid + Neonicotinoid	Benzoyl Urea IGR	Benzoyl Urea IGR	Carbazates	Tetronic Acid	Tetramic acid derivative (ketoenole)	Neonicotinoid	BioPesticide	Benzoyl Urea IGR	Napthoquinone derivative	Carbazates + Glycosides	BioPesticide
MOA Group	15	U	3	4a + 3	15	15	U	23	23	4a	Microbial	15	20B	U + 6	M
Pest															
Aphids		X	X	X					X	X	X			X**	X
Mealybugs		X	X	X					X	X	X				X
Soft Scales		X	X	X						X					X
Armored Scales		X	X	X						X					X
Whiteflies	X	X	X	X	X**			X	X	X	X	X		X**	X
Lace Bugs			X	X						X					
Leafhoppers		X	X	X					X	X	X				X
Leaf Feeding Beetles		X	X	X						X	X				
Thrips		X	X	X						X		X		X**	
Leafminers	X*	X	X	X	X*	X				X	X	X		X	
Caterpillars	X	X	X	X	X	X					X	X			
Fungus Gnats	X	X	X	X						X	X				
Shore Flies	X		X								X				
Flatheaded Borers				X						X					
Grubs		X		X						X					
Spider Mites							X	X	X				X	X	X
Tarsonemid Mites								X						X	X
Weevils		X		X		X				X	X				

*Lepidoptera leafminers

**Suppression

OHP Quick Reference Insecticide Product Rate Guide

Insecticides / IGRs / Miticides

Products	Rate per 100 gallons	Rate per 1 gallon
Adept®	½ ounce (drench) or 2 ounces (spray)	See label for more information
Azatin® XL	5 to 16 fluid ounces	⅓ tsp to 1 tsp
Decathlon® 20 WP	1.3 to 1.9 ounces	⅕ tsp to ¼ tsp
Discus® N/G	25 to 50 fluid ounces	1½ tsp to 3 tsp
Floramite® SC	4 to 8 fluid ounces	¼ tsp to ½ tsp
Judo™	2 to 4 fluid ounces	⅛ tsp to ¼ tsp
Kontos™	1.7 to 3.4 fluid ounces	⅒ tsp to ⅕ tsp
Marathon® 1% G	see label	⅛ to 1½ tsp per pot depending on size
Marathon® II	1.7 fluid ounces	⅒ tsp
Marathon® 60 WP	1 WSP treats 1000 6" pots	See label for more information
Pedestal™	6 to 8 fluid ounces	⅜ tsp to ½ tsp
Shuttle™ O	6.4 to 12.8 fluid ounces	⅔ tsp to ⅘ tsp
Sirocco™	3 to 6 fluid ounces	⅜ tsp to ⅝ tsp
Triact® 70	½ gallon, 1 gallon, 2 gallons	3¾ tsp to 7½ tsp to 15 tsp (5 TBS)

Always read all labels before using any insecticide/miticide products. If you have any questions contact your local OHP representative.

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OHP, Inc.
PO Box 230
Mainland, PA 19451
Technical Service: (800) 356-4647
ohp.com

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