

Pest Control

What is eating my plants and how can I stop them?



Spider Mites

You'll first suspect spider mites when your plants start showing up with little yellow speckle marks, right on the leaf surface. (Also see thrips.) When you turn the leaf over, tiny, oval shaped mites are seen scurrying around, about pin-head in size. Their eggs, best seen with a magnifier, will be scattered around at random (perfectly round, all the same size, colour ranging from clear to tan). With larger infestations, a fine webbing can be seen covering the plant tops (crawling with mites), and leaves will be browning and dying. Spider mites seem about the most common pest to show up in a greenhouse or indoors. They're best controlled with spider mite predators, similar sized mites that eat them. A few gardeners report success with pirate bugs or ladybugs.

Spider mites take about 2 weeks per generation at 70 F. (from egg to adult). At low temperatures below about 50°F. They become dormant, and at higher temperatures above 86 F., their life cycle is sped up to about double. They prefer lower humidity levels, so raising the humidity helps control them.

The most common mite species by far is the "two-spot: spider mite. They're usually yellow/tan/greenish in colour, and have two dark spots on their shoulders, one on each side. How large these spots get depends on the age of the mite; they get larger as the mite gets older. These two spots are also varied according to how much chlorophyll is in the plant being reared; some crops produce mites colour much darker than others.

Strangely, spider mites have the ability to go dormant in winter, and then return when it warms up again. Triggered mostly by the daylight getting shorter in the fall, some or most of the mites turn red in colour, stop feeding and egg laying, and then crawl off to protected nooks and crannies to hide through the winter. A warm, heated greenhouse can counteract these impulses to hibernate, but some probably will anyway, so it's easy to see why spider mites tend to keep coming back -season after season. Spider mites can also float along with wind currents, or be carried by pets or clothing. The common two-spot spider mite is found throughout the world, it's so widespread.

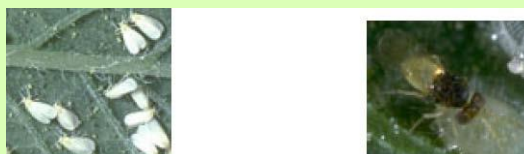
GOOD BUGS TO THE RESCUE!

Feeding only on spider mites (and their eggs), spider mite predators also breed twice as fast, making them our most popular mite control. Actually carnivorous mites, each predator feeds on about 5 spider mites a day, or 20 of their eggs. Used as directed, predators should gain control within 4 weeks, and then continue until the spider mites are nearly or completely wiped out later. Predators disappear when the mites are gone.

Surprisingly, spider mite predators are this effective even through they're no larger than the spider mites, and sometimes smaller. Shaped a little more streamlined, they have longer legs which let them run faster, too. Attacking from the side, they suck the juices out of their spider mite prey.

For best results, start with at least 1 predator for every 25 spider mites. (1 to 15 for ornamentals, where appearance is important.) No, you don't have to count every mite! Count the mites on just a leaf or two, on perhaps every 10th plant, Average them out, estimate the garden population, and divide this by 25 for the number of predators to use. If this sounds too complicated, start with 2 predators per leaf, or perhaps 30-50 per plant. Using more predators gives faster control.

We have 3 kinds of predator mites that can all be used together or separately. Their different temperature and humidity preferences are listed on the chart. They all like higher humidity's (70-90%); you'll note that tolerance for lower humidity varies. Cool temperatures in the low 50's tend to make them go dormant, but they'll actually survive short periods down almost to freezing. Upper temperature limits vary according to species. They're all priced the same, and you can order any combination at no extra cost. If you don't specify, we'll send a mix of all 3 kinds.



White flies

Whitefly Parasites

Whiteflies

Suspect whiteflies when you start seeing small (1/12"), pure white "moths" that are mostly resting on the plant leaves. When disturbed, all rush out in the air, hesitate a while, then fly back into the foliage. Looking closer, the plants might appear shiny with honeydew.

With a magnifier, small clear-white "scales" (the pupa) are seen on the lower, underneath sides of the plants. All stages suck on plant juices, and heavily infested plants will yellow and grow poorly.

There are at least 2 whitefly species now causing distress for gardeners, greenhouse whitefly and sweet-potato whitefly. For greenhouse whiteflies use whitefly parasites. Whitefly parasites work against sweet-potato whiteflies, too, but not as well. For these we suggest you also use whitefly predators, and possibly also green lacewings. (It's difficult to tell whitefly species apart, but one chart appears below. We suggest you check with your county agent to be sure -you can have both.) You can also use yellow sticky traps -seriously, whiteflies are attracted to the colour yellow. Our yellow whitefly traps are coated with a long lasting sticky substance (Stickem-Special), and the whiteflies fly right to them. (Don't wear yellow clothing around whiteflies -you'll just carry them from plant to plant!) Some gardener's use a vacuum cleaner -one person rustles the plant leaves to stir up the whiteflies, the other sucks them out of the air (paint the inlet bright yellow for extra attraction). Make a game of it! What finally kill plants off with a heavy whitefly infestation aren't usually whiteflies themselves, but a black sooty mould that grows on accumulated honeydew. By the time plants get to this stage, there'll be clouds of whiteflies, and no mistaking this pest. If you're at that point, rinse the shiny coating off the plants with a strong water or soapy water spray, so the mould can't grow on it. Rinsing off excess honeydew helps your beneficial insects, too.

GOOD BUGS TO THE RESCUE!

Whitefly Parasites (*Encarsia formosa*)

Tiny whitefly parasites lay their eggs inside developing whitefly pupa, so one of their babies hatches out instead of the whitefly! So small their flights are measured in inches, not feet, you'll probably not even see whitefly parasites (except with magnification), but they spell death for whiteflies. For fastest control, make 4 releases of parasites, spaced 2 weeks apart for greenhouse whitefly. If you have sweet-potato whitefly, continue with releases every 2 weeks until control is reached. 1000 whitefly parasites are enough for a 1000 square foot greenhouse with a low-level infestation (a few whiteflies per plant).

Encarsia formosa come packaged ready to hatch, glued to small cards. The perforated cards are hung from plant foliage, and parasites emerge as adults within 2 weeks. Then they fly off, and begin looking for more whitefly pupa to parasitize. Since they're so tiny, how do you know they're working? With greenhouse whitefly, within 10 days the parasitized pupa turns totally jet-black in colour, instead of its normal clearishgreen colour. With sweet-potato whitefly the pupa turns only slightly yellowish, but after 2 or 3 weeks the "emergence hole" can be seen in both cases when the adult parasite chews his way out (16X magnifier required). Parasites work best when temperatures average at least 68°F. (Add daytime + night-time temperatures, divide by 2), Lower temperatures than these will require more frequent releases, at least monthly.



Aphids



Ladybug Eating Aphid

Aphids

What you notice first with aphids is leaves that are curled, puckered, and discoloured. Looking closer, dense colonies of tiny (1/32"-1/8"), soft bodied, pear shaped insects are seen, especially on tender growing tips and underneath sides. Young aphids look like miniature adults, and the whole family will be found feeding together. Even when disturbed, aphids move quite slowly, compared to most other insects.

Coming in almost every colour, aphids can be green, yellow, pink, brown, or black, or any shade in between, for that matter. To make a final diagnosis of aphids, with a magnifier, find the pair of tiny "dual exhaust pipes" coming out of their rear end, called "cornicles" -aphids are the only insects that have these. Aphids all feed by sucking on plant juices, which is damaging enough, but their most serious damage is the plant diseases they carry -that's what causes the leaf distortions so often seen with aphids. They produce shiny honeydew, too, and when enough of this builds up a choking mould starts growing that can quickly kill plants. (Keep this mould hosed off.) Combine these problems along with aphids unusual breeding abilities -they're born already pregnant (in fact, there are miniature embryos inside of other embryos!), they're all female, and they reach adulthood in one week -and you see why aphids can be such a rapidly devastating pest. There are lots of aphid species, too, with enough variety that just about every plant has at least one species that really likes it.

Ladybugs are the classic aphid eaters, and are known for sometimes dramatically fast cures. They're economical, and can be stored in the refrigerator, often making ladybugs the first choice for aphid control. Long-term control is sometimes better with aphid predators, larvae that devour aphid colonies, and breed from there. Green lacewings are also effective against aphids. Our newest control is aphid parasites. Between these choices, greenhouse aphid control is usually quite successful. These same aphid controls are effective in the outdoor garden, too, with regular releases.

GOOD BUGS TO THE RESCUE!

Ladybugs

Everyone loves ladybugs (*Hippodamia convergens*), it seems. Maybe it's that childhood nursery rhyme. Happily, they're good for your garden, too. Ladybugs eat over 5000 aphids (or other soft bodied pests) during their lifetime (about one year). Many gardeners look on them as kind of a good-luck charm. Ladybugs don't always provide the pest

control expected, but we hear enough rave-success stories to make them worth trying.

Besides that, they're fun "garden pets" to have around. Ladybugs are one of the few beneficial insects that can be stored in the refrigerator, dormant. (Well, maybe not in everyone's refrigerator...) They store up enough food to last several weeks, so long as they don't freeze or dry out. You can then let a few out every week or so, as needed. If ladybugs tend to fly away, you can spray their backs with a soda pop/water spray (instructions included) -it "glues" their wings shut so they can't fly! (After a week or so it wears off.) p 1,500 ladybugs is enough for a small garden, a quart (18,000) covers a large garden (or perhaps makes several releases), while a gallon (72,000) covers 1-10 acres. We hope they bring you good luck, too.

Aphid predators (*Aphidoletes aphidimyza*)

Aphid Predators lay their eggs near aphid colonies, which soon hatch and begin feeding on aphids. To reach full development takes at least 10 aphids, but when aphid populations are high, many more are destroyed -first paralyzed with a poison, then sucked dry. Killed aphids remain attached to plant leaves, and eventually dry up. Are these guys' bad, or what? Aphid predators have worked so well in many greenhouses that by summer aphids may be hard to even find. And they usually set up breeding populations from a single release. 250 are enough to handle a small greenhouse, while 1000 covers a larger greenhouse. Commercial greenhouses have used 3000-4000 per acre, repeated weekly during the aphid season until control. (Regular releases get them going faster.) Aphid predators come as cocoons waiting to hatch, packaged in bottles. Spread the contents on the soil or leaves, and they'll do the rest.

Aphid Parasites

(*A. matricariae*) are our newest tool in the battle against aphids, they lay their egg inside the aphid, which then develops into a parasite larva. Before finishing development inside the aphid egg, the larva spins a cocoon, turning the unfortunate aphid into a leathery "mummy". The adult parasite then flies out from a circular hole cut in the mummy. For preventative control small releases will get these established, repeat regularly through the season. These are used in European greenhouses, but are new here. Supplied near hatching, or as adults (no choice).

Green Lacewings (*Chrysopa rufiflavis*)

These are another of the walking "garbage disposal" appetites of the insect world -if it's an insect or egg that fits in their mouth, they'll eat it. That's why green lacewings are suggested for control of many pests, both outdoors and in the greenhouse, when there's nothing more specific available. Lacewings immediately begin eating pests after hatching. Looking like miniature "alligators", they grow to almost 1/2" long over 3 or 4 weeks, consuming 400+ aphids or other pests in the process. After that, they pupate into a beautiful adult insect, feeding only on nectar and pollen from flowers. Unless adults find nectar and pollen sources, they won't lay more eggs, so you may need to reapply them for good pest control. We suggest using 4000 eggs per backyard or 5000-50,000 acre (depending on infestation), repeat every 2 weeks through the pest season.

Green lacewings are now available in their most effective predator stage, as just-hatched larvae. These are the same efficient predator as above, but pre-fed and ready to use immediately. Several studies have shown pre-hatched, pre-fed larvae to be far more effective than lacewing eggs, plus they go to work faster. You get more actual larvae to use, because they aren't cannibalizing each other (something lacewing larvae are notorious for) right after hatching.

1000 pre-hatched larvae are enough for an average back yard or small greenhouse. For best results, repeat every two weeks whenever target pests are present. Allow one week for delivery,
As these are custom produced for each order.



Thrips

Pirate Bug Eating Thrip

Thrip Predatory Mite

Predatory Nematode

Thrips

Tiny, slender thrips feed by scraping and rasping at tender leaf surfaces. First symptoms are usually leaves that appear finely speckled with yellow spots. Later, a silvery-metallic looking sheen may cover leaf surfaces (not with all thrips, though), and black specks (thrips faecal material) may be scattered about. Only after close inspection is the real pest found. About 1/10" long, thrips can move quite quickly for their size. To the bare eye, many gardeners report thrips as a small "worm" with legs. Both larvae and adults look similar, except adults have wings and can fly. In small numbers, thrips may not do much damage. However, with larger populations, they can be quite damaging.

There are hundreds of varieties of thrips, coming in many colours, but they all feed and damage plants similarly. For control purposes, the main difference is where they pupate as youngsters. Most pest thrips move down into the soil (they'll also use rockwool or other synthetic media) to pupate, as part of their lifecycle, where they can be controlled by predator nematodes. This is the easiest stage to kill. It does take 2 or 3 applications before good control is seen, however, because only the immature thrips are killed, and not the adults. These adults can be controlled with Safers Soap, if necessary, and after 2 months regular applications of predator nematodes alone usually gives good control. A few other thrips species pupate directly inside leaf tissue. (Notably the species greenhouse thrips), where the nematodes are not as effective.

You can tell if thrips are using the leaf to pupate, because when they are, the hatching thrip causes a small eruption on the leaf surface -it looks something like a tiny pimple, or a little volcano complete with crater. Unhatched eggs look like a little dab of Elmer's glue. If you see these signs, thrips parasites are a good control. (Other thrips species that pupate in the soil are not controlled by these.)

Other natural thrip controls include thrips predatory mites (see right) which work well in greenhouses with higher humidity levels, green lacewings, and pirate bugs. A few gardeners report success with ladybugs too.

Cool temperatures help control thrips, too -they seem most damaging in hot greenhouses with temperatures 90 and higher. Thrips also prefer lower humidity levels, and higher humidity's help slow them down.

GOOD BUGS TO THE RESCUE!

Thrips predator mites (Arnblyseiu's cucumeris)

These are effective thrip feeders under high humidity (70-85%) growing conditions, against all species of thrips. They also will eat an occasional spider-mite and other small pests. However, reports have been poor with lower humidity environments, so these are most useful for greenhouses and other locations with high humidity levels. Often, Predator Nematodes alone will contain thrips, so we recommend them first for most thrips control. But in some gardens thrips predator mites have been an excellent control. Use 100-500 per plant, reapply as needed. Thrips parasites (*Thripobius semileutius*) are a good control for thrips that pupate in leaf tissue, as opposed to the soil (like most do). How can you tell? When you examine leaves closely, if you see little eruptions on the leaf itself (these are caused by the thrip hatching, and look like miniature "volcanoes", somewhat like a pimple with a crater in the middle, and are very obvious under magnification), then thrips parasites will be effective. Otherwise, use another control. (It's normal for many thrips species to leave black fecal specks on leaves, along with a "silvery" film, but these look nothing like the "craters" that leaf-pupating thrips cause when hatching.)

Pirate bugs

Pirate bugs (*Orius tristicolor*) also eat spider mites and aphids. Only 1/20" long, adults eat up to 20 thrips larvae a day. Both nymphs and adults use a piercing-sucking beak to pierce a hole and suck victims dry. Shipped as nymphs near hatching. These are too new to have established release rates, but in Europe they've been effective greenhouse controls when others alone were not. 500 covers a 1000' greenhouse, they'll breed from there. Repeat as needed.

Fungus Gnats & Fleas

When you see small, dingy-grey flies flying around aimlessly, or seeming to come out of the soil, you've probably got fungus gnats. Adults look very similar in size and appearance to fruit flies, and don't feed on plants in any way. Their larvae, a small worm that lives in the top inch or two of the soil, feeds mostly on organic debris, fungus, algae, etc. While they're doing this, however, they can nibble on the roots of young seedlings, too. Plants usually outgrow them rapidly, though, so they're often more of a nuisance than a real pest.

Fungus gnats can be told apart from whiteflies, a much more serious pest, because fungus gnats are a dingy grey instead of pure white, and they don't spend much time resting on the leaves like whiteflies do.

If fungus gnats seem to be causing harm or becoming a nuisance, the adults can be quickly trapped out with yellow sticky traps. Long term control has been best with predator nematodes, applied to the soil every 4-6 weeks. Between the two, fungus gnats are soon a forgotten problem.

Just about everyone with dogs or cats is familiar with fleas. Not only do fleas cause our pet's true misery, but many humans are severely bothered as well. Fleas bite because they need blood meals to complete their lifecycle. Flea saliva secreted while feeding causes many common allergic reactions, on both people and pets. Pets can't help carrying around fleas and their eggs wherever they go. Those fleas and eggs are constantly dropping off, in sleeping areas, rooms pets have access to, and outside. Thorough vacuuming (including crevices) every 3 days controls house fleas. However, for fleas in the yard, new research shows that Predator Nematodes sprayed outside where pets have access to, especially during moist periods, greatly reduces flea populations, before they even crawl on your pets in the first place.

GOOD BUGS TO THE RESCUE!

Predator Nematodes

Predator Nematodes are some of the most useful pest controls to come along in years, because if an insect spends part of its life cycle in the soil (lots of them do), predator nematodes want to kill them -it's as simple as that. Looking like microscopic worms, predator nematodes attack and kill more than 250 different insects, including fleas, thrips, fungus gnats, even ones as large as cutworms. After invading the insect body (through mouth or anal openings), they go on to reproduce on the remains, migrating back to the soil when nothing but a shell is left. Predator nematodes attack only insects, too -never plants, earthworms, or other soil creatures, and they're unrelated to pest nematodes. But if it's an insect spending time in the soil, they zoom in for the kill.

Predator nematodes are so small and economical that they're sold by the package of one million, which treats up to 3000 square feet of growing area (24 million per acre). Nematodes come packaged on a small piece of sponge that's rinsed out in water, then watered into the soil using a watering can, sprayed on with a garden sprayer (no, the pressure doesn't hurt them -they go through the nozzles fine), fertilizer-injector or siphon feeder -it doesn't matter. Nematodes live and reproduce in any moist soil media, including rockwool, as long as they find insects to feed on.

Although predator nematodes live for a few months, for best results make repeat applications every 4-6 weeks throughout the period when your target pest(s) are present to keep a high concentration in the soil. (Every 2 weeks for rockwool and other artificial soil media.) Nematodes will store dormant in the refrigerator 2-3 months before use, so it's easy to keep some on hand. Soil temperatures below the low 50's bring on dormancy, too, so a soil thermometer is useful for timing outdoor applications.

Not all predator nematodes are alike -ours are live-reared on live wax-moth larvae, so they come out actively feeding, breeding, and very vigorous. Some other nematodes are raised on artificial diet, or even dehydrated for long storage, and these are not nearly as active, vigorous, or effective as our live-reared nematodes. We have a mix of 2 kinds, heterorhabditis and steinernema species, for control at different depths in the soil.

We've had great results with predator nematodes, and find regular application controls (prevents) a wide variety of insect problems before they ever occur.



Mealy bugs



Mealy bug Destroyers

Mealy bugs

Another insect that sucks on plant juices, mealy bugs cause damage similar to aphids -leaves will be distorted, plants are weakened, covered with shiny honeydew, and finally a sooty mould grows, killing the plant. However, when a search is made for the cause, they don't look much like insects. Clusters of mealy bugs look more like some kind of cottony mass instead of pests. It's only on close examination that they're seen to be individual, soft bodied, very slow moving insects.

Coated with a fluffy, waxy coating, mealy bugs tend to gather quietly together in groups, often at a crotch or joint in the plant. But don't let this innocent looking crew fool you. Even though mealy bugs breed somewhat slower than other insects (each generation takes about a month), they can build up to quite damaging populations. Fortunately, we have mealy bug destroyers that like to feed on them. Green lacewings feed on mealy bugs too, but need to be released regularly. And be sure to keep that honeydew rinsed off the plants as much as possible, with a water or soapy water spray, to keep mould from growing. Between these measures, you should get good control.



Scales

Mealy bug Destroyers

Scales

Related to mealy bugs, scales don't look much like insects, either -they look more like little oyster shells attached to the stems and leaves. Active only as babies, they soon lose their legs, grow a hard outer shell, and settle in for a quiet life of sucking on plant juices. Often, the first symptom noticed is shiny honeydew covering the leaves. (Not all scales produce this.) Looking closer, especially on the undersides of leaves and stems, the scales are visible, singly or in clusters. Shaped circular to slightly oval, they readily scrape off with a fingernail. Plants may be stunted, yellowed, and distorted, damage similar to that of other sap-sucking insects.

There are many varieties of scales, hard and soft, coming in many colours, but all feed and damage similarly. Mealy bug destroyers also feed on scales when mealy bugs run low, and green lacewings feed on the crawler stage, giving some control. Scale control with natural predators has been variable, and we continue to search for improved controls. Many gardeners resort to spraying or dabbing alcohol, light oil, soapy sprays, or mixtures of the above for scale control. Test a small area for toxicity from any of these products first.

GOOD BUGS TO THE RESCUE

Tiny (1/8") black ladybugs, mealy bug destroyers (*Cryptolaemus ontmuzieri*) are originally from Australia; and are some of the oldest, most successful biological controls. Back in the early 1900's they were credited with saving the Southern California citrus crop from mealy bugs. They're still used today for the same purpose. As you can imagine, they work well under greenhouses conditions, too. Mealy bugs are their main diet, but they eat scales and aphids, too, when other food gets scarce. Mealy bug destroyers have large appetites for such a small insect, so a few go a long way -we suggest 2-5 per infested plant, or 1 for every 2 feet of planted area. They'll set up breeding populations from there. Repeat as necessary.