

# Insect Pests of Roses

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We have tens of thousands of different species of insects and mites in Mississippi. Only a tiny percentage of these are pests of ornamental plants, and even fewer attack roses. Still, there are some insects and mites that cause real problems for rose growers. Being able to identify these pests and distinguish them from non-pest species is the first step in control.

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**Aphids** (about 1/8 inch): Aphids are small, slow-moving, soft-bodied insects with piercing-sucking mouthparts. Several species occur on roses, but the rose aphid is one of the most common. Female aphids give birth to live aphid nymphs, which are able to become mothers themselves within a week to 10 days. In addition most aphids are females, which are able to reproduce without mating. Consequently, aphids can quickly reach high populations.

**Damage:** Aphids cause damage by sucking plant sap. Because they often concentrate on tender growing tissue, like terminals and flower buds, they can cause distorted or stunted growth. These insects excrete a sticky substance known as honeydew, which contains large amounts of undigested sugars. Honeydew accumulates on leaves and supports a black fungal growth known as sooty mold. Sooty mold fungi are not pathogenic, but accumulations of sooty mold are unsightly and can interfere with photosynthesis.

**Management:** Fortunately, there are many naturally occurring predators, parasites, and diseases that help keep aphid populations in check. Avoid unnecessary insecticide use, which can trigger aphid outbreaks by destroying these natural control agents. When heavy accumulations of aphids are detected on terminals or buds, you can use a forceful spray of water to physically wash them from the plant. Avoid excessive amounts of nitrogen fertilizer as this encourages aphids.

**Control:** Acephate, imidacloprid, malathion, disulfoton, insecticidal soap, pyrethrins + canola oil. Soil-applied systemic insecticides like imidacloprid or disulfoton will help prevent aphids. When foliar treatments are needed, products like insecticidal soap, neem oil, or canola oil are least disruptive to biological control. For heavy infestations that require immediate control use foliar sprays containing acephate, imidacloprid, or malathion.

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**Whiteflies** (1/16 to 1/8 inch): Whiteflies are related to aphids. Adult whiteflies are small moth-like insects that are covered with a white waxy powder. There are several different species, but all carry their white, powdery wings folded tent-like over the body. They most often occur on the undersides of leaves, but clouds of adults will fly around infested plants when

disturbed. Immature whiteflies are immobile, scale-like insects that feed on the undersides of leaves. They are flattened and oval-shaped, and, depending on the species, may have waxy filaments protruding from their bodies. However, these traits are difficult to see without the use of a hand lens.

**Damage:** Like aphids, whiteflies suck plant sap through piercing-sucking mouthparts. They are also similar to aphids in their tendency to build to high populations and their ability to produce large amounts of honeydew, which eventually results in sooty mold.

**Management:** Avoid unnecessary insecticide treatments, which can disrupt natural biological control.

**Control:** imidacloprid, acephate, malathion, *insecticidal soap*, *Neem Oil*, *Horticultural oil*, *pyrethrins + canola oil*: Imidacloprid is useful for control of whiteflies when applied as a soil drench. When attempting to control whiteflies with foliar sprays be sure to apply at least two successive treatments five to seven days apart.

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**Thrips:** (about 1/16 inch) Thrips are some of the most important insect pests of roses. There are several species, with flower thrips and western flower thrips being two of the most common. Thrips are tiny, elongate insects that are no more than 1/16<sup>th</sup> of an inch long when fully mature. Most adults have fringed wings that they carry folded lengthwise over the body, but these are only evident when viewed through magnification. Immature thrips are usually light yellow to lemon colored and are spindle-shaped.

**Damage:** In roses, thrips can cause damage mainly by feeding on flowers. Their injury reduces the aesthetic value of the blooms of roses and heavy infestations can prevent buds from opening. Thrips feed by punching plant cells with their needle-like mandible and sucking up the resulting plant juices. This results in silvery or bleached damaged areas, on flower petals, that eventually turn brown. Because feeding is often concentrated on young, actively growing tissue, petals and leaves are often crinkled or distorted as they continue to expand after being damaged.

**Management:** Because thrips are carried by prevailing winds, strategically placed windbreaks, either structural or plant hedges, can help protect rose plantings from the heavy populations of migrating thrips that often occur in late spring. These won't intercept all of the wind blown thrips, but where feasible, such windbreaks can help reduce this heavy thrips pressure.

**Control:** acephate, malathion, imidacloprid, cyfluthrin, cyhalothrin, permethrin, spinosad, insecticidal soap: Soil drench treatments of imidacloprid will aid in control of foliage feeding thrips, but thrips feeding in flowers are more difficult to control. During late spring to early summer, large numbers of thrips migrate from maturing weeds and other hosts. Weekly sprays may be necessary to minimize damage during such periods of heavy migration. Thrips also breed directly on roses and these 'local' populations can require control throughout they year. Spinosad is one of the more effective foliar treatments for thrips control.

**Chile Thrips:** Chile thrips, *Scirtothrips dorsalis*, is a non-native thrips species that has recently invaded Florida. As of 2006 it had not yet spread into Mississippi, but it has the potential to do so, and rose growers need to be aware of this potential invasive species. Chile thrips attack a wide range of host plants, including roses. Unlike most species of thrips that occur on roses, Chile thrips feed primarily on foliage, although they also feed in blooms. Heavy infestations can cause discoloration and distortion of rose leaves, resulting in severe damage. These symptoms are sometimes mistaken for herbicide or disease injury. If you notice these types of symptoms in your roses, use a hand lens to check for thrips on the undersides of leaves. Report suspected infestations to your local County Extension office and/or the Mississippi Department of Agriculture. Spinosad, applied as a foliar spray, is one of the most effective treatments for Chile thrips, but it will take several treatments to obtain control.

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**Leafhoppers:** (1/8 to 1/2 in.): Leafhoppers are active, elongate, somewhat wedge-shaped insects. They have piercing-sucking mouthparts and readily run, hop, or fly when disturbed. There are many different species; most are green to yellow, but some species are brightly marked with yellow, red, or blue.

**Damage:** Both adults and nymphs feed on the undersides of leaves and on tender stems, sucking the sap and causing leaves to become spotted, or to turn yellow. A white or yellow stippling of the leaves is one of the most common symptoms in roses. The stippling caused by leafhoppers is usually larger and more widely spaced than that caused by spider mites. In most cases leafhoppers are minor pests that seldom cause serious injury.

**Control:** Cyfluthrin, cyhalothrin, malathion, carbaryl, imidacloprid, permethrin, *insecticidal soap*, *pyrethrins + canola oil*: Apply foliar sprays as needed. Foliar sprays containing cyfluthrin, cyhalothrin or permethrin will provide good contact control of nymphs or adults. Soil drenches of imidacloprid will provide some control, but are rarely applied specifically to control leafhoppers.

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**Spider Mites** (1/32 in.): Although they are not insects, spider mites belong to a closely related group. Adult spider mites are so small that they are barely visible to the naked eye, but you can see them easily through a 10X hand lens. Adults of most species are somewhat globular in shape and have eight legs. There are many different species and color may vary from red to green or yellow. One of the more common species, the two-spotted spider mite has a dark spot on either side of the body.

**Damage:** Spider mites are some of the most common arthropod pests of roses, and some of the most difficult to control. They feed by sucking the fluid from plant cells. Adults and nymphs cause similar injury. Feeding by low numbers of mites is inconsequential, but these pests have a very high reproductive potential and can complete a generation in as little as 7 days. Heavy infestations are capable of causing severe injury and can even kill plants. Feeding by individual mites causes localized cell death, resulting in light colored 'stippling'. However, when mite

populations are heavy these individual feeding sites coalesce, giving leaves a ‘bleached’ or bronzed appearance. Severely injured leaves may curl and drop from the plant. Initially mite infestations are normally confined to the undersides of leaves, but under heavy infestations the mites will produce webbing, hence the name spider mite, and will occur on the tops of leaves and on other plant parts.

**Management:** Populations of plant-feeding mites are often kept in check by species of naturally occurring predatory mites and other predators. Outbreaks of spider mites often occur following insecticide treatments targeted against other pests, because these treatments destroy the predatory mites. Avoid unnecessary insecticide treatments. Foliar applications of carbaryl, acephate, or pyrethroid insecticides have a tendency to trigger mite outbreaks and outbreaks are also more likely to occur on plants that have been treated with imidacloprid. Outbreaks of some species of mites are favored by hot dry weather, especially if accompanied by dusty conditions. Keeping plants well watered during periods of drought helps reduce the potential for mite outbreaks. Washing foliage with a water spray can also be beneficial in controlling, or preventing, mites, especially if you take the time to direct the water spray to the undersides of the leaves. Do this early in the day in order to reduce the potential for encouraging disease.

**Control:** fenbutatin-oxide, *insecticidal soap, neem oil, horticultural oil, pyrethrins + canola oil:* Few specific miticides are available for use by homeowners. Horticultural oils provide effective mite control when thorough spray coverage is achieved. Fenbutatin oxide, sold as a pre-mix with acephate, is one of the few specific miticides still available to homeowners. When treating for mites it is important to apply two or more successive treatments four to five days apart, in order to effectively break the life cycle. Choose product carefully. Using ineffective products, or inadequate treatment intervals, can result in intensified mite problems. Remember, most of the mites are on the bottoms of the leaves; direct your spray there.

Serious rose growers often resort to using commercial miticides. There are several effective commercial miticides that are not classified as ‘restricted use’ and can therefore be purchased and applied by serious hobbyists/commercial producers. Be aware, however, that these miticides can be very expensive. If you use these products be sure to read and follow the label and wear all required personal protective equipment (PPE). Don’t fall into the trap of relying too heavily on miticides, just because they work well initially. Spider mites can quickly develop resistance to miticides to which they are over exposed. Take advantage of other methods of mite control, and switch to a different miticide after one or two successive sprays, as indicated on the label.

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**Scale Insects** (less than 1/8 inch): Several species of armored scale occur on roses, with rose scale being one of the more common. Scale insects do not look like insects at all. Their bodies are covered with a hard scale-like covering, that may be round, elliptical, tear-shaped, or oyster shell-shaped, depending on species. These scale covers often blend in with the bark of the plant, making the scale difficult to detect. Female scale deposit eggs which hatch into tiny crawlers. These crawlers do not move very far from where they hatched before inserting their mouthparts into the plant and beginning to feed and form their scale cover. From this point forward they remain in this location and, if they are females, do not move for the remainder of their lives.

**Damage:** Scale damage plants by using their thread-like sucking mouthparts to suck sap from the plant. Heavy infestations also cause tissue damage as they probe and feed on plant cells. Scale infestations can reduce plant vigor and growth. Heavy infestations can cause the death of whole limbs or even whole plants.

**Management:** Avoid purchasing scale infested plants, and keep plants healthy and vigorous so they can better resist and/or tolerate infestation. Prune and discard heavily infested canes.

**Control:** Horticultural oil is one of the best treatments for control of armored scale, but thorough coverage is critical, because only scale that are directly covered by the spray will be controlled. Soil applications of the systemic insecticide disulfoton will also help control armored scales. Read and follow label directions.

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**Japanese Beetles:** (about 1/2 inch) Although they are present in Mississippi, Japanese beetles are not yet well established in the state. They are common in southern Tennessee and Northwestern Alabama, and are most likely to be seen in neighboring areas of North Mississippi. Adult Japanese beetles are robust shiny metallic green and copper colored insects. They also have a row of white tufts of hairs on each side, around the edge of the abdomen. Look for these white tufts of hair to help distinguish them from other metallic colored beetles, such as the Green June Bug. The larvae are white grubs that feed on the roots of grasses.

**Damage:** Where they occur, Japanese beetles are one of the most important insect pests of roses. It is the adult beetles that cause damage in roses. They are strong fliers and migrate from nearby turfgrass, where the larvae developed, to feed on blooms of roses and other plants. Although they will feed on foliage, Japanese beetles cause damage primarily by feeding and disfiguring blooms. They are especially attracted to light-colored blooms.

**Management:** Handpicking and destroying adult beetles is a non-insecticidal method of control that can be reasonably effective on small-scale plantings when infestations are light. Some gardeners use protective mesh cages to protect the buds and blooms of especially prized specimens. Foliar sprays containing azadirachtin have been shown to repel Japanese beetles.

**Control:** Carbaryl, imidacloprid, cyfluthrin, cyhalothrin, permethrin: Unfortunately, soil-applied systemic insecticide treatments will not prevent adult Japanese beetles from damaging rose blooms. Where Japanese beetles are common, repeated foliar insecticide treatments are necessary to prevent excessive bloom damage, but be aware that frequent spraying increases the potential for spider mite outbreaks.

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**12-Spotted Cucumber Beetles:** (about 3/8 inch) These beetles are a shiny greenish yellow with 12 black spots on their backs. They are one of the more common beetle pests of roses. Adults migrate to roses from larval hosts. The larvae feed on the roots of various plants,

but they are not serious pests of roses. There are several other species of beetles that occasionally attack rose blooms in a similar manner, and earwigs will also feed on rose blooms.

**Damage:** Adult cucumber beetles damage roses by feeding on the petals. A single beetle often does not cause enough damage to be aesthetically damaging, unless blooms are to be cut for sale or exhibition, but blooms can be disfigured by several beetles feeding in the same bloom.

**Control:** acephate, carbaryl, imidacloprid, cyfluthrin, cyhalothrin, permethrin: Foliar sprays of pyrethroid insecticides (cyfluthrin, cyhalothrin, or permethrin) are effective against cucumber beetles. Carbaryl is also effective, but is even more likely to flare mites than pyrethroids.

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**Caterpillars and Sawflies:** (length varies) Several species of caterpillars and sawflies occasionally attack roses. Caterpillars are the larvae of moths or butterflies. Sawflies are the caterpillar-like larvae of a special group of wasps that feeds on plant leaves. Rose slugs are some of the most common sawflies that attack roses. There are actually several species of rose slugs.

**Damage:** Caterpillars and sawflies cause damage by feeding on the leaves, resulting in leaf skeletonization or defoliation. Severe defoliation is unsightly and can interfere with plant growth. Sawflies are especially prone to skeletonize leaves. Some species of caterpillars feed as leaf rollers. A few caterpillars, like tobacco budworm and some of the armyworms, will feed on blooms, but this is not common.

**Management:** Hand picking can be an effective way to control isolated infestations of caterpillars or rose slugs, especially on small plantings. You can also use a forceful spray of water to wash rose slugs, from the plants.

**Control:** acephate, *Bacillus thuringiensis*, carbaryl, cyfluthrin, cyhalothrin, permethrin, spinosad: Foliar sprays of spinosad are probably the best treatment for caterpillars and sawflies, because they are less disruptive of the beneficial insects and mites that help control other pests, like mites and aphids, but broad spectrum treatments, like pyrethroids or carbaryl, will work. *Bacillus thuringiensis* products are also effective against leaf-feeding caterpillars, but not against rose slugs. Because they are slow-acting Bts work best when applied when caterpillars are small.

**Rose Midge** (1/20 inch): Fortunately this insect is not common in Mississippi, but Mississippi rose growers need to be aware of this pest and able to recognize symptoms. It is a serious pest of roses across the Northern regions of the country. The adults are tiny mosquito-like flies. The larvae are legless maggots, only about 1/12 inch long, that feed inside the tissue of growing plant tips. Because of its size, this insect is easy to overlook, at least initially. It is hard to overlook the damage that heavy infestations can cause, but this damage is often not recognized as insect injury.

Damage: It is the larvae, or maggots, that cause the damage. They feed in the tips of developing shoots, causing them to be blackened and distorted and to fail to produce blooms. Heavy infestations can result in greatly reduced bloom production.

Management: Prune and destroy infested tips as soon as you detect them.

Control: Imidacloprid + cyfluthrin: These insects overwinter as pupae in leaf litter at the base of the plant. A soil drench containing imidacloprid, or imidacloprid + cyfluthrin, applied in early spring will control emerging adults before they have a chance to lay eggs. Hose-end sprayers are the easiest way to apply such treatments. In areas with heavy infestations gardeners may have to apply foliar sprays several times during the growing season to control adults.

**Leafcutting Bee** (5/8 inch): This solitary bee builds its nest in hollow stems, reed, or pipes. It stuffs the nests with pieces of leaves that it cuts from various plants and uses this as food for its developing larvae. Roses are one of their preferred plants for cutting leaves.

Damage: Adult bees cut semicircular holes in rose leaves, usually affecting only a few leaves on any one plant. These bees sometimes build their nests in the ends of garden hoses, and gardeners sometimes discover the tightly packed columns of leaf material when they turn on the water.

Control: There's little that can be done to control this bee. Fortunately damage is usually minor.

# Insecticides and Miticides for Use On Roses

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Although there are hundreds of different insecticide products labeled for use in the home landscape, there are only a few dozen different active ingredients. When purchasing insecticides for use in the home landscape, it is important to think in terms of active ingredient, rather than brand name. Brand names can be confusing, and even misleading. This section provides general information about insecticides and miticides most commonly used on roses.

**Use Insecticides Safely!:** Before using any insecticide or miticide, always be sure to read the label carefully and follow all label directions regarding personal protection equipment and instructions for mixing and applying the product. The label is the law, and the use directions it specifies are designed for the safety of the applicator, the environment, and those using the area. Handle insecticides with the respect they deserve. They are poisons and excessive exposure can result in acute and/or chronic health problems.

**Be Sure the Insecticide is Labeled for Use on the Plant(s) Being Treated:** Some insecticides may actually cause injury, or phytotoxicity, to certain landscape plants. Before applying an insecticide to a particular species of plant, be sure to read the label and verify that the product is labeled for use on that particular species/variety.

## Specific Insecticides and Miticides Used on Roses

**Acephate:** Acephate is currently sold under the brand name Hi-Yield Acephate. It is also sold as Ortho Systemic Insect Killer, which is a premix that includes the miticide fenbutatin oxide. One reason for including the miticide is that acephate has a tendency to flare spider mites when applied alone. Acephate is a systemic insecticide that is effective against sucking insects like aphids, whiteflies, and scales, as well as thrips, and many caterpillars and beetles. This is a useful broad spectrum insecticide for rose growers, but it does stink!

**Carbaryl:** Carbaryl is most commonly sold under the brand name Sevin. This product has been a standard for home insect control for many years. In roses it is most useful for controlling beetles, like cucumber beetle and Japanese beetle. However, carbaryl has a strong tendency to flare spider mites (trigger population increases).

**Malathion:** Malathion is another long time standard insecticide. It is useful for control of aphids and certain beetles, but there are probably better options for roses.



**Disulfoton:** Disulfoton is only available as a granule for soil application. It is a systemic insecticide that is absorbed by the roots and translocated through the plant. Disulfoton is useful against many sucking pests, such as aphids and some scales, as well as thrips and some other insects. Bonide Systemic Granules and Bayer 2-in-1 Systemic Rose and Flower Care Ready-to-Use Granules are two common products that contain disulfoton.

***Bt kurstaki:*** *Bacillus thuringiensis* is a bacteria that produces compounds that are toxic to certain insect species. There are different species and strains of this bacteria that produce different toxins. *Bt kurstaki* produces a compound that is toxic to certain caterpillars but has no effect on other insect species. Thuricide is one of the more common brand names. *Bt kurstaki* is effective against leaf-feeding caterpillars, but is not effective against sawfly larvae, which are easily mistaken for caterpillars. *Bt* is most effective against small larvae and attempts to control large caterpillars with *Bt* products may give disappointing results.

**Imidacloprid:** Imidacloprid is a systemic insecticide that has recently been labeled for use by homeowners. It is sold under the brand name Bayer Advanced Garden Tree and Shrub Insect Control, and, in this formulation, is applied as a soil drench around the roots or ornamental plants, rather than as a foliar spray. There are several other formulations sold for homeowner use. One is a combination of imidacloprid and a fungicide. In the commercial horticulture pesticide market imidacloprid is sold as Merit, which is available as either a granular product or a liquid concentrate. Imidacloprid is especially effective against sucking pests, such as aphids, leafhoppers, and whiteflies when applied as a soil drench. It is relatively slow acting, but often provides long-term control. Imidacloprid is also sold as a premix, in combination with cyfluthrin, for application as a foliar spray.

**Spinosad:** Spinosad is a relatively new microbial insecticide that is very effective against most caterpillar pests and sawfly larvae. It is also one of the better treatments for thrips, but is not effective against most other types of insect pests. Two commonly available brand names that are labeled for use in the home landscape are: Monterey Garden Insect Spray and Fertilome Bore, Bagworm, Leafminer, and Tent Caterpillar Spray. Spinosad is sold as Conserve SC in the commercial horticulture market. There is also a formulation known as Entrust that is approved for organic production.

**Insecticidal Soap:** Insecticidal soaps are potassium salts of fatty acids. They control insects that they contact by disrupting cell membranes. They are most effective against soft-bodied pests, such as aphids, mites and thrips. Direct contact with the pest is necessary in order to achieve control. Safer Insecticidal Soap is an example of one brand name. Many plants can be injured by insecticidal soaps, especially if applied at excessive rates. Be sure to read the label carefully before treating.

**Neem Oil:** Neem oil is a botanical product that is primarily useful against aphids, mites, whiteflies, and scale crawlers. It is labeled for use on most landscape plants and is sold under several brand names (Monterey 70% Neem Oil is one example). Thorough coverage of the pest is necessary in order to obtain control.

**Horticultural Oils:** Horticultural oils are highly refined paraffinic oils that are used to control scale insects, spider mites and other small insects. They work through contact activity. Because oils work by contact activity, spider mites are not likely to develop resistance. Horticultural oils may be applied as dormant sprays as well as during the growing season. Read and follow the label carefully to avoid plant injury. Horticultural oils can be especially useful against infestations of hard to control armored scales, like rose scale. Commonly available brand names include Sun Spray Ultra-Fine Year Round Pesticidal Oil, Volck Oil Spray, and Fertilome Scalecide.

**Rotenone:** Rotenone is a botanical insecticide that is used primarily by organic gardeners. It is often sold as a 'premix' with pyrethrin. Bonide Liquid Rotenone-Pyrethrins Spray Concentrate is one example. It is labeled for use on certain ornamental plants and is useful in the control of aphids, certain beetles, and some caterpillar pests. Rotenone is moderately toxic to mammals.

**Pyrethrin:** Pyrethrin or pyrethrum is a botanical insecticide that is primarily used by organic gardeners. Monterey Bug Buster O is one common brand name. This insecticide provides rapid knock down of most insects, but insects often recover. Piperonyl butoxide (PBO) is often mixed with pyrethrin to act as a synergist. This increases the overall effectiveness, and helps prevent pests from recovering. Pyrethrin or pyrethrin + PBO is active against a wide range of insects, but its efficacy is limited by its very short residual activity.

**Pyrethroids:** The term 'pyrethroids' refers to a group of relatively new synthetic insecticides that are modeled after the botanical pyrethrum molecule. These products are effective against a wide range of insect pests and are used at very low rates. The following pyrethroid insecticides are currently labeled for use in the home landscape.

**Permethrin:** Permethrin is the oldest, and most common, of the pyrethroid insecticides. It is widely available and is sold under a large number of different brand names (Martin's Vegetables Plus, Bonide Eight Vegetable, Fruit and Flower Concentrate, and Hi-Yield 38 Plus, Turf, Termite, and Ornamental Spray are three examples). Permethrin is labeled for use on many different ornamental plants and is effective against a wide range of pests. Note, that permethrin is often confused with pyrethrin, however there are considerable differences in the overall effectiveness and residual control provided by these two insecticides.

**Cyhalothrin:** Lambda cyhalothrin is one of the newer pyrethroid insecticides. Triazicide Soil & Turf Insect Killer Concentrate is the most common brand name. It is effective against a number of different insect pests, and is labeled for use on most ornamental plants.

**Cyfluthrin:** Cyfluthrin is another relatively new pyrethroid insecticide. It is sold under the brand name of Bayer Advanced Garden Power Force Multi-Insect Killer Concentrate. Like cyhalothrin, it is effective against many different insect pests and is labeled for use on most landscape plants.

**Esfenvalerate:** Esfenvalerate is one of the older pyrethroid insecticides. It is labeled for use on many different ornamental plants and controls a wide range of insect pests. Two common

brand names are Monterey Bug Buster and Ortho Bug-B-Gon Garden & Landscape Insect Killer Concentrate.

**Acephate + fenbutatin-oxide:** This product is sold as a premix of two different active ingredients under the brand name Ortho Systemic Insect Killer and is labeled for use on most woody and herbaceous ornamentals. Acephate (originally sold as Orthene) is a systemic insecticide that is effective against a wide range of insect pests. Fenbutatin-oxide is a specific miticide. This product is especially useful against sucking pests, such as aphids, whiteflies, scale insects, and mites. It will also control thrips.

**Cyfluthrin + Imidacloprid:** This is a pre-mix sold under the brand name Bayer Advanced Garden Rose and Flower Spray. It is packaged as a concentrate and as a pre-diluted ready-to-use spray, which is labeled for use as a foliar spray on most ornamental plants, including roses. It is also sold in a 'ready-to-spray' hose-end applicator.

Cyfluthrin is a pyrethroid insecticide that provides control of a wide range of insect pests. Imidacloprid is a systemic insecticide that is especially effective against sucking pests, such as whiteflies, aphids, and scale. This mixture works well against thrips. Because of its broad label and the broad spectrum of insect pests controlled, this is a very useful product for control of insect pests in the rose garden and home landscape. The hose-end applicator is an especially effective, and easy to apply, treatment for rose midge. However, this product is not effective against spider mites.

**Commercial Miticides:** Spider mites will quickly develop resistance if repeatedly treated with the same product. This means you must rotate the use of different miticides in order to prevent resistance. The following miticides are available through suppliers of commercial horticulture products and specialty rose suppliers. These are some of the most useful miticides for commercial producers and serious hobbyists, but they are costly.

**Abamectin:** Avid 0.15 EC is an excellent miticide that also controls leafminers. For heavy infestations apply a second application after 7 days, but rotate to a different miticide for subsequent applications. Avid controls adult and immature mites and exhibits good translaminar movement (moves from top of leaf to bottom).

**Bifenzate:** Bifenzate is sold as Forbid 2 SC in the commercial ornamentals pesticide market. It is an excellent general miticide that provides quick knock down and long-term residual control. It also has ovicidal activity. Do not make more than one application before rotating to a different miticide.

**Ettoxazole:** Etoxazole is sold as TetraSan 5 WDG. It has good activity against immature mites and eggs and also good translaminar activity. Translaminar activity means that it will move from the top side of the leaf to the bottom, a useful feature for a miticide. Do not make more than one application before rotating to a different miticide, and do not exceed two applications per year.

**Hexythiazox:** This miticide is sold as Hexygon DF in a 50% wettable granule formulation. The label specifies "for commercial use only". Hexygon controls eggs and immature mites but does

not kill adults. However, female mites exposed to hexythiazox will not lay viable eggs. Do not apply more than once per year. Rotate to alternative miticides.

**Spiromesifen:** This is a relatively new miticide that is sold commercially as Forbid 4F, which is a liquid concentrate. It provides good control of spider mites and will also control whiteflies. Do not make more than one application before rotating to a different miticide, and do not exceed three applications per year.