

Spider mite

What are spider mites?

Spider mites are not insects but are more closely related to spiders, they belong to a class called *Arachnida*.

What can you see?

Spider mites (most) spin a silk webbing. When spider mites infest plant leaves, they damage plant tissue leaving yellowing and dead spots that coalesce until the entire leaf is affected. The leaf will turn yellow, wilt and finally be shed. Other mites include varieties that do not spin webs and live in the plant bud terminals where damage is not seen until tip expansion.

What can you do?

Spider mites have several natural enemies that can be used to control the population.



Pests & Diseases

Whitefly



What are Whiteflies?

Whiteflies are hemipterous insects belonging to the Aleyrodidae family. They can cause considerable damage and loss of production.

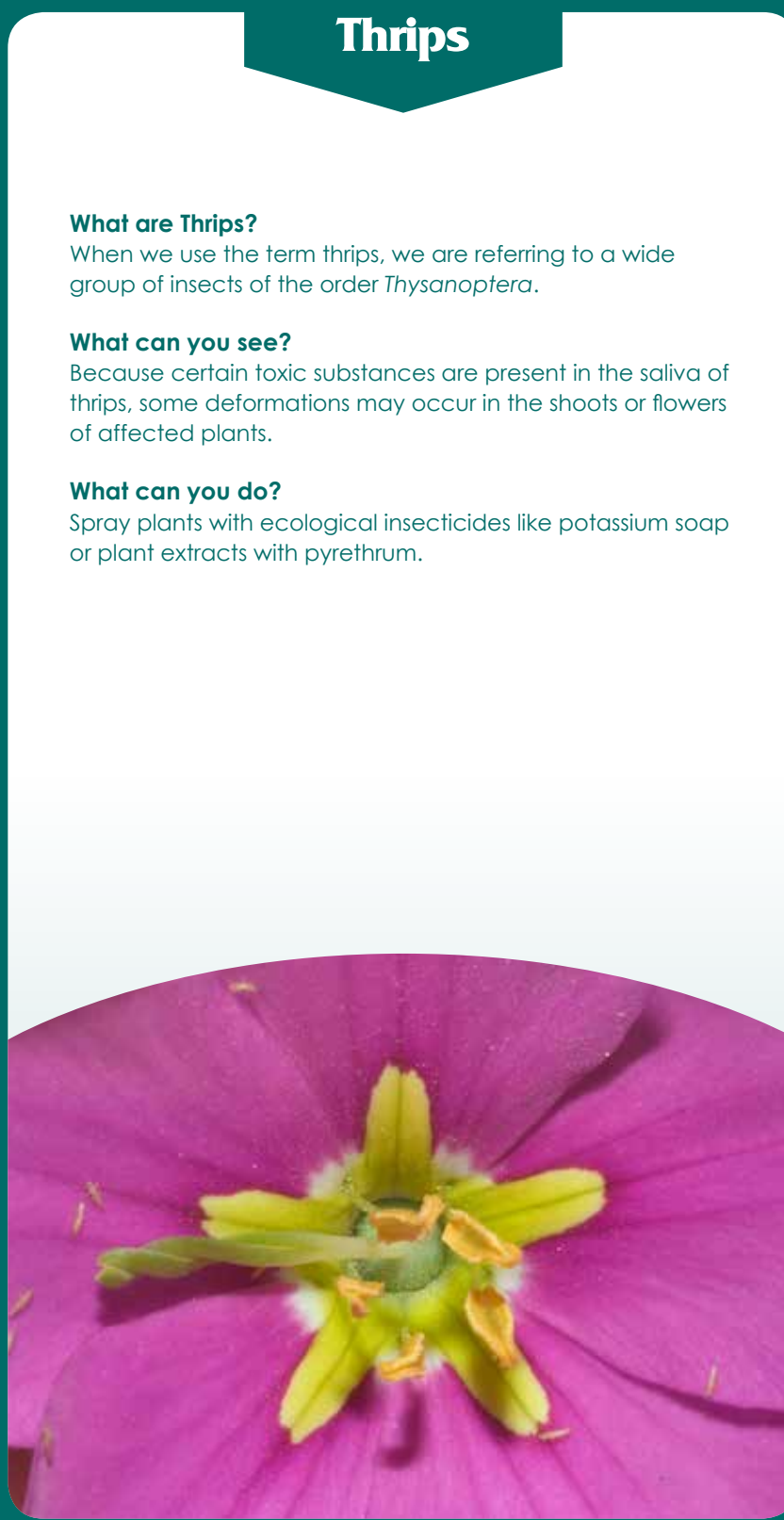
What can you see?

Discolored patches on the parts of the leaf when they have been feeding.

What can you do?

One of the main objectives when controlling whitefly is to avoid the crop being infected by a virus that the insect can carry.

Thrips



What are Thrips?

When we use the term thrips, we are referring to a wide group of insects of the order *Thysanoptera*.

What can you see?

Because certain toxic substances are present in the saliva of thrips, some deformations may occur in the shoots or flowers of affected plants.

What can you do?

Spray plants with ecological insecticides like potassium soap or plant extracts with pyrethrum.

Aphids



The main symptom of a root aphid attack in the aerial part is chlorosis, similar to a nitrogen deficiency.

What are aphids?

When we refer to aphids, or plant lice, we usually mean a super family of insects which includes over 4,000 species of plant-specific parasites.

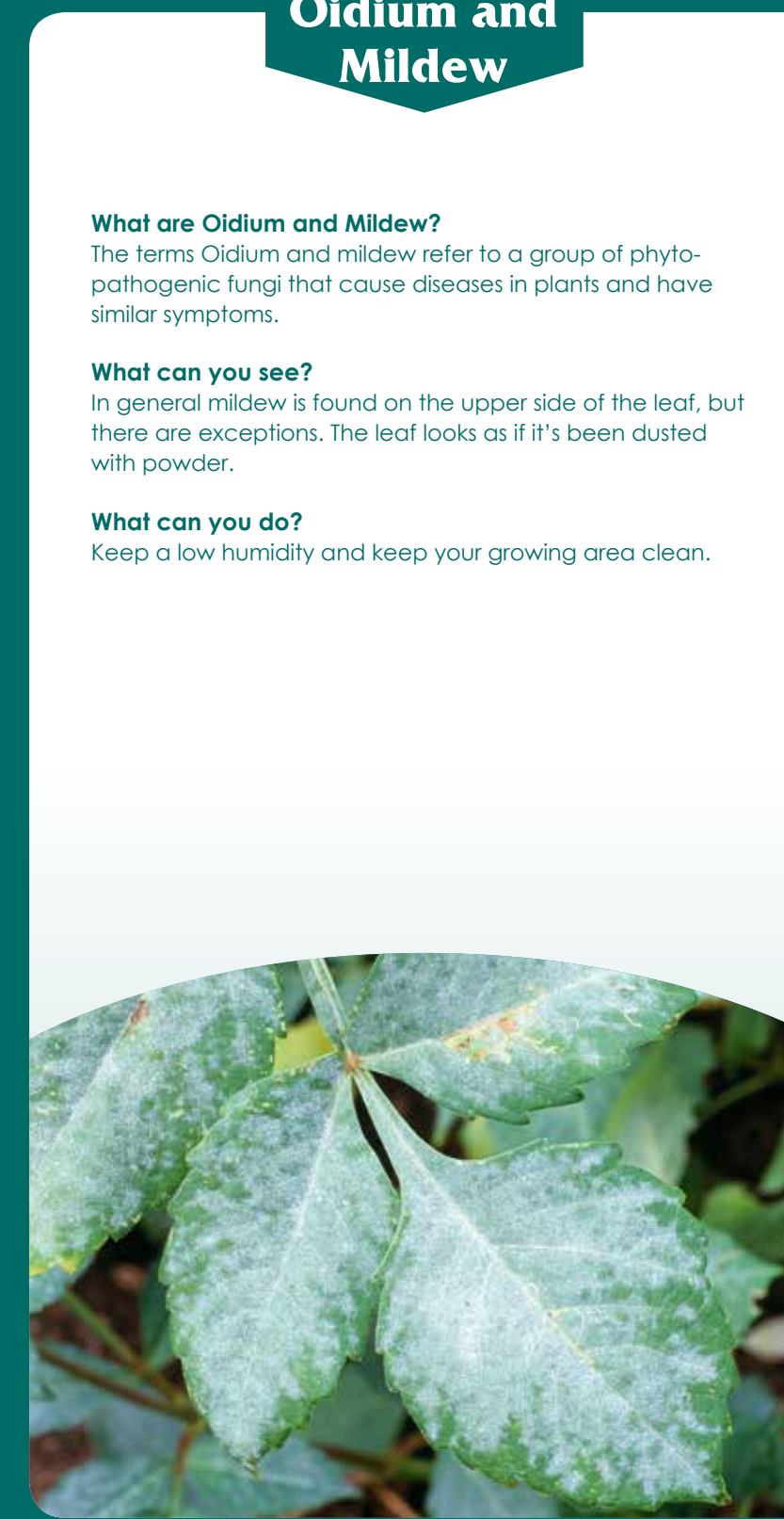
What can you see?

Aphids can cause decreased growth rates, mottled leaves, yellowing, stunted growth, curled leaves, browning, wilting, low yields and death in plants.

What can you do?

There are several cultivation techniques that we can use to prevent or minimize an attack of aphids.

Oidium and Mildew



What are Oidium and Mildew?

The terms Oidium and mildew refer to a group of phytopathogenic fungi that cause diseases in plants and have similar symptoms.

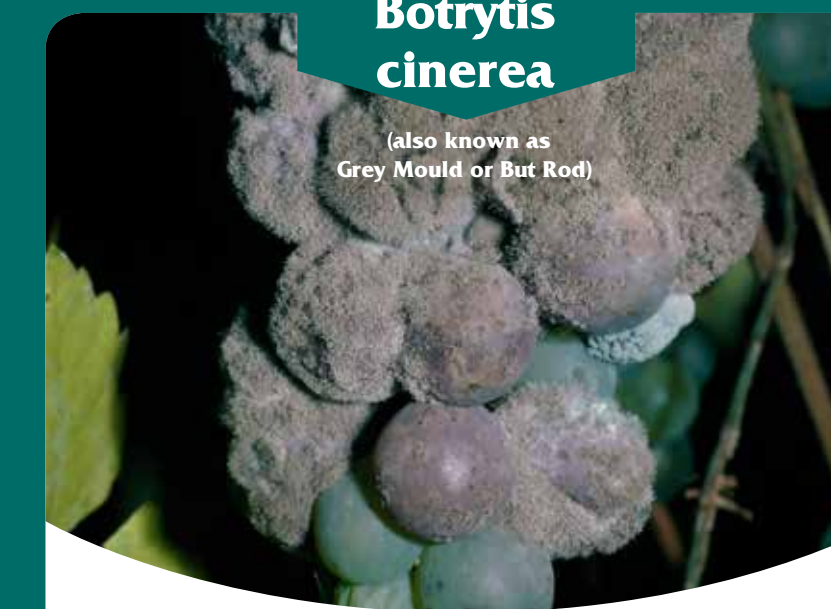
What can you see?

In general mildew is found on the upper side of the leaf, but there are exceptions. The leaf looks as if it's been dusted with powder.

What can you do?

Keep a low humidity and keep your growing area clean.

Botrytis cinerea



(also known as Grey Mould or But Rod)

What is Botrytis (Grey mould/But Rod)?

Botrytis cinerea is a necrotrophic fungus, which means that it kills its host to obtain all the nutrients it needs.

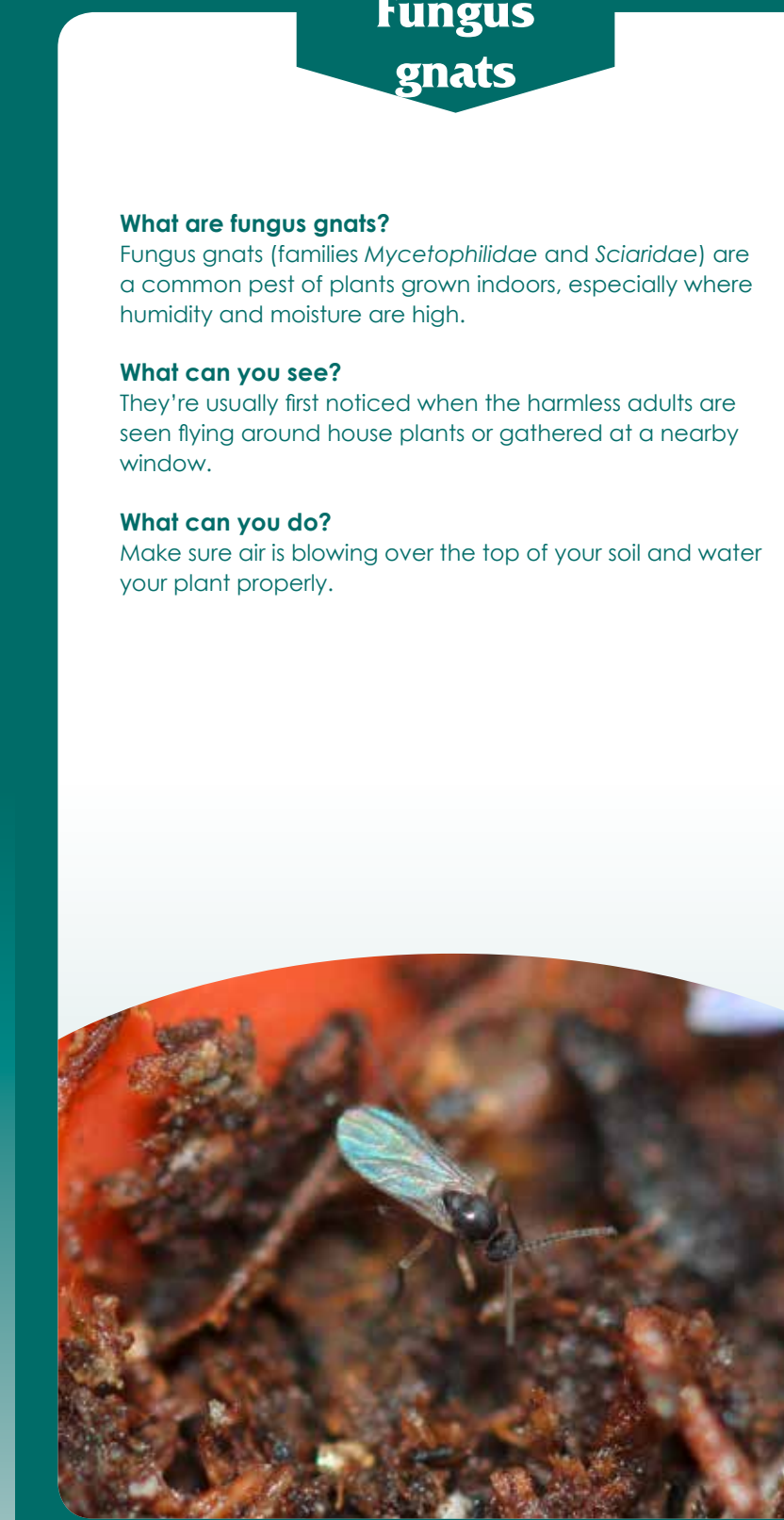
What can you see?

The tissue on which it develops becomes dark and sometimes soft, due to the death of the host cells. In time, a layer of furry grey mold will form on these dark spots.

What can you do?

You must never allow the infected plant or parts of the plant to come into contact with other plants.

Fungus gnats



What are fungus gnats?

Fungus gnats (families *Mycetophilidae* and *Sciaridae*) are a common pest of plants grown indoors, especially where humidity and moisture are high.

What can you see?

They're usually first noticed when the harmless adults are seen flying around house plants or gathered at a nearby window.

What can you do?

Make sure air is blowing over the top of your soil and water your plant properly.

Curled, yellow, brown or spotted leaves, stunted growth, silk webbing between leaves or even the death of a beloved plant: it is a grower's worst nightmare. Beautiful greens and healthy plants full of flowers can suddenly become really unhealthy. Finding out what went wrong is not always easy, but the CANNA Pests and Diseases Guide can help shed some light on the matter.

Spider mites, whiteflies, thrips, aphids, mildew, fungus gnats and Botrytis cinerea are very common pests and diseases that can affect many plants, and they are probably some of the most stubborn too. Each one can cause considerable damage to your plant and it is not always easy to get rid of them.

This CANNA Pests and Diseases Guide provides some background information about these common pests and diseases (including the biological cycle), and tells you all you need to know about symptoms, prevention and control.

Still hungry for more information? CANNA Research is happy to share its expertise and provides growers with a full range of growing information through its magazine, CANNAtalk. The magazine is available at www.cannagardening.ca, where you can also submit your own question and receive a personal answer from CANNA Research.

Spider mite

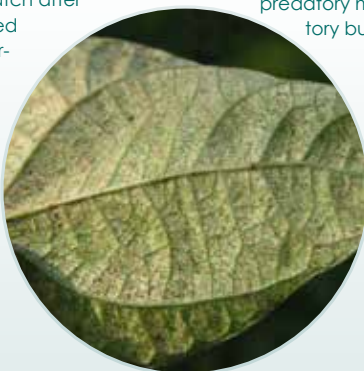
About the pest in short

Spider mites are a pest that affects many crops worldwide. There are well over 1200 species of spider mite, of which more than a hundred can be considered as a pest, and about ten of those as major pests. The most well-known and problematic spider mite is *Tetranychus urticae* (common names include red spider mite and two-spotted spider mite). Their ability to reproduce extremely rapidly enables them to cause enormous damage in a short period of time.

Spider mites have needle-like sucking mouthparts. They feed by penetrating the plant tissue with their mouthparts. Large populations may cover entire plants with webbing. These webs are also used to move themselves. Because spider mites are so small they can move through ventilators.

Biological cycle of spider mites

Each female two-spotted spider mite lays 10-20 eggs per day, 80-120 altogether during its life cycle of up to 4 weeks. These are mostly attached to the silk webbing. The six-legged larvae hatch after 3-15 days. Newly hatched larvae are almost colourless and have bright red eyes. They moult three times within 4-5 days, towards protonymph, then deutonymph and at last adult. Both adults and nymphs have 8 legs.



Symptoms of a pest

The first visible symptoms are small yellowish or whitish specks, mainly around the midrib and larger veins. If these spots grow bigger and merge, the empty cells give some areas of the leaf a whitish or silvery-transparent appearance.

How to prevent the pest?

To minimize the risk and rapid spread of spider mite infestations, try to keep the temperature lower (<25°C) and the humidity higher (>60%), since this will slow the rate of reproduction. However, higher humidity is needed for the predators of spider mite. Keep your growing areas clean, remove leaf litter. Adequate irrigation is important, because water-stressed plants are more likely to be damaged.

Solutions to control the pest

When you see spider mites (recognizable by silk webs on top of the leaves), remove the affected leaves. Flush the plant thoroughly with a mixture of alcohol and soap. Repeat this treatment several times a week. You can also use natural enemies: predatory mites, ladybirds, predatory bugs and lacewings.

Whitefly

About the pest in short

The two species of whitefly that affect many crops are *Bemisia tabaci* or tobacco whitefly and *Trialeurodes vaporariorum* or glasshouse whitefly. The main morphological difference that enables these to be distinguished from one another is the position of the wings. In *B. tabaci*, these are joined to the body and in *T. vaporariorum* they are parallel to the surface of the leaf. Furthermore, the adult and pupa of *T. vaporariorum* usually has a greater quantity of waxy powder than *B. tabaci*.

Biological cycle of Whitefly

The full life cycle of the whitefly lasts between 15 to 40 days, depending on environmental conditions, particularly the temperature, as eggs will turn into adults more quickly when the temperature is higher. The whitefly usually lays its eggs on the underside of the leaves and the eggs stick to them.

Symptoms of a pest

The direct damage is caused to the plant as the whitefly feed. The sucking of the sap leaves discolored patches on the parts of the leaf when they have been feeding. Furthermore, as they suck out the sap, they release toxic substances into the phloem, which then spread throughout the plant. This leads to metabolic imbalances in the plant which leads to overall weakening, chlorosis and changes to the flowers and fruit. In terms of indirect damage, the molasses excreted by the nymphs enables fungi such as sooty mold (*Capnodium* sp.) to form on the leaves.

This mold acts as a screen and reduces the photosynthetic capacity of the plant. However, the most serious damage that the whitefly can cause to crops is the transmission of viruses.

How to prevent the pest?

One of the main objectives when controlling whitefly is to avoid the crop being infected by a virus that the insect can carry. Therefore, any weeds or remains of other plants that are near the crop should be removed as these can act as a habitat for the whitefly. Furthermore, if a whitefly feeds off a weed that contains a virus and then reaches your crop, the virus can easily be spread. The use of protective barriers such as nets and covers are also a good option for preventing infestations.



Solutions to control the pest

A range of entomophagous insects, parasites, and some entomopathogenic fungi are used to control whitefly. Most of the predators feed on the eggs and nymphs of the whitefly. This category includes the *Delphastus catalinae* beetle. The chrysopidae larva and some bedbugs are also good biological controllers of this pest. The small wasps of the *Aphelinidae* family are parasites of the whitefly larva, where the wasps lay their eggs and they develop by feeding off their host.

Thrips

About the pest in short

A thrips is characterized by its small size and long flat shape. The adult thrips has four feathery wings. They can vary from gray to yellow or brown in color. Thrips are carriers of viruses, mainly of the genus *Tospovirus*. These viruses cause significant crop loss and they are incurable.

Biological cycle of thrips

The first stage of the thrips' life cycle is the egg, which will hatch much more quickly when temperatures are higher. The females lay the eggs within plant tissues. The larvae that emerge from the eggs feed on the surrounding tissues. One of the characteristics of these insects is that they make the transition from pupa to adult in the soil or in lower leaves. The larvae live in the leaves, but as soon as they reach the appropriate stage of development, they fall to the ground or lower leaves where they live during the pre-pupal and pupal stages until a reproductive adult appears with fully developed wings. The whole life cycle lasts only a few weeks.

Symptoms of a pest

The feeding of the adult thrips is varied and based mainly on pollen, but the larvae feed on plant tissues and it is the larvae that are responsible for the majority of plant damage. The larvae suck the liquid from plant cells, mainly from the leaves, but also the petals, shoots and fruits. Early symptoms include an almost transparent or clear discoloration of the leaf with black dots (which correspond to fecal secretions). They have rasping – sucking mouth parts that look like combs and that make a soup from the tissue which is then sucked up. Usually the top layer of the tissue is undisturbed and a window or clear tissue is seen in the middle of the spotting.



How to prevent the pest?

Because certain toxic substances are present in the saliva of thrips, some deformations may occur in the shoots or flowers of affected plants. In cases of very severe infestation, the leaves may dry up entirely. At the same time, some thrips like *Frankliniella occidentalis* secrete a few drops of a substance when they are threatened by predators. These excretions contain decyl acetate and dodecyl acetate – pheromones that serve as a warning signal for other nearby thrips.

How to prevent the pest?

Because of the thrips' ability to transmit viruses, it is important to monitor our crops for thrips and detect them as early as possible. The classic method for doing this is using adhesive traps. These traps are blue in color, since thrips are strongly attracted to blue. The traps should be examined every few days using a magnifying glass to see if any thrips (usually winged adults) have become stuck to them.

Solutions to control the pest

If you detect thrips, appropriate treatments need to be administered to minimize the risk of an infestation. These treatments include ecological insecticides like potassium soap or plant extracts with pyrethrum, where these are allowed by law. Plants must be sprayed thoroughly all over because the larvae suck the liquid from plant cells, mainly from the leaves, but also the petals, shoots and fruits. Early symptoms include an almost transparent or clear discoloration of the leaf with black dots (which correspond to fecal secretions). They have rasping – sucking mouth parts that look like combs and that make a soup from the tissue which is then sucked up. Usually the top layer of the tissue is undisturbed and a window or clear tissue is seen in the middle of the spotting.

Aphids

About the pest in short

Aphids are not longer than about 4 mm, have a bulbous abdomen and can be many different colors. They are among the most destructive pests on cultivated plants in temperate regions. Winged aphids are specially dangerous for your crops, as they destroy plants much faster than regular aphids.

Biological cycle of aphids

Aphids can be winged or wingless. Usually the first generation to emerge from the winter egg are wingless. However, after several generations there can be a lack of space on the host plant. This triggers the birth of a generation of winged aphids, which can migrate to other hosts. All the aphids born from the winter eggs are females. Several more generations of female aphids are born during the spring and summer. A female can live for 25 days, during which time she can produce up to 80 new aphids. Spring and summer reproduction occurs asexually – without males.

Symptoms of a pest

The removal of phloem sap for food weakens the plant and causes a metabolic imbalance, twisting of the leaves and, in extreme cases, leaf loss. Leaf loss affects the quantity and quality of the final harvest. They also introduce toxins into the plant, systemically altering its development.

The honeydew secreted by the aphids is an ideal culture medium for various fungi which form a barrier on the leaf, stopping it from taking in all the light that hits it.



How to prevent the pest?

There are several cultivation techniques that we can use to prevent or minimize an attack of aphids. These include:

- Eliminating weeds that can serve as a reservoir of eggs and adults.
- Using insect nets (sometimes insecticide-impregnated) to cover crops.
- Avoiding the excessive use of nitrogenous fertilizer.
- Removing crop residues
- Establishing plant species that can serve as a reservoir for predators (banker plants).

Solutions to control the pest

The natural enemies of aphids are predators such as ladybird beetles (or ladybugs) and lacewings. Green lacewing larvae (*Chrysoperla* sp.) are voracious predators of aphids.

Oidium and Mildew

About Mildew

Mildew is known as 'downy mildew'. As the disease spreads, the leaves curl up, necrotise and eventually fall off. The parts of the mycelium containing the spores of this fungus emerge through the stomata of the plant. In good light it can readily be identified as a gray to purple felt on the back of the leaves.

About Oidium

Oidium is known as 'powdery mildew'. Before any symptoms become clear the leaf starts to develop blister-like patches, and this is followed by the characteristic white powder where the blister was. The leaf looks as if it's been dusted with powder. In general mildew is found on the upper side of the leaf, but there are exceptions. One type of mildew only grows on the underside of the leaf, so it's no surprise it often gets overlooked. However, as the disease advances, the leaves can end up being completely covered in this white layer and it can even colonize the buds, with subsequent losses in crop size and quality.

How to prevent the pest?

The best treatment against these types of fungi is prevention: once they have set in and developed they are very difficult to eradicate, sometimes even with chemical fungicides. Try to prevent spores coming in from elsewhere and contaminating your plants by keep your growing area clean. You do this by using only clean equipment and wash your hands thoroughly before entering.



Solutions to control the pest

Check older leaves regularly for light yellow discoloration and fungal growth.

- You can remove suspect leaves and keep these in a resealable freezer bag with some moist paper in a warm place. After two days you can check the leaves for mildew, maybe using a magnifying glass.
 - Remove any contaminated leaves, but also make sure that you don't spread the disease yourself. Make sure you wash your hands regularly, preferably with an alcohol solution.
 - Burn infected material.
 - Use a fungicide.
 - Don't forget that you'll need to repeat the spraying several times.
- If you want to use biological products to stop the fungus you will need to bear in mind that the effect is not very long-lasting; so unless you get the timing right, all you'll be doing is wasting time and money. A product that is effective against one type of Oidium may not work against another similar-looking mildewy fungus.

Botrytis cinerea

(also known as Grey Mould or But Rod)

About the pest in short

Botrytis attacks weak plants or dying flowers. In fact, in nature it helps the recycling process of plants by breaking them down and making the nutrients available in the soil. So the fungus actually plays a vital role in the natural growth cycle. But when it strikes your crops, it's a pest!

Biological cycle of Botrytis

Early development of gray mold usually starts in infected plant debris from previous crops, which have been left in the field. The mycelium present in the debris begins to develop when temperatures increase, for example in early spring. In bright light, the mycelium begins to produce structures called conidiophores. At the end of these conidiophores, spores called conidia are formed which are then transported through the air and can come into contact with the leaves or stem of crops.

Symptoms of a pest

The fungus infection in flowers is not visible initially. Necrosis – tissue that looks brown and wet near the infection site – is one of the first symptoms that indicate a possible Botrytis attack. A lighter colored spot on the flowers with a dark brown ring around it can also indicate a mold infection.

How to prevent the pest?

It is very important to get rid of any parts of the plant that are infected with Botrytis. The infected parts should be removed immediately. You must never allow the infected plant or parts of the plant to come into contact with other plants, because even the briefest contact will send clouds of gray spores into the air.



These spores will then land on healthy plants which may then get infected. Good ventilation is essential in order to maintain slightly lower humidity around the leaves and flowers. For outdoor crops, it is advisable to cover the plants with a plastic shelter like a poly-tunnel when rain is expected. This prevents the plant from getting wet.

It is also important to be vigilant against pests such as caterpillars which can cause damage to the cuticle, which *B. cinerea* can exploit to enter the plant more easily. It's easier for the fungus to infect plants that have been damaged by chewing pests. Other insects like thrips can carry and spread Botrytis spores.

Solutions to control the pest

Several microorganisms have proven to be successful in controlling *B. cinerea* in a wide variety of crops. *Clonostachys rosea* (= *Gliocladium roseum*) is a fungus that is used to combat and prevent Botrytis attacks because of its ability to suppress the production of spores. Some nematode species have also been used to control gray mold effectively. Many plant extract preparations are marketed primarily to prevent the attack and development of *B. cinerea*. Good results have been achieved with extracts of thyme, citrus seed, oregano, mint, garlic and pepper, to name but a few.

Fungus gnats

About the pest in short

The adult fungus gnat is a small black fly, about 3-4 mm in length. They are commonly seen swarming in greenhouses because they are attracted by the humidity, high temperatures and decomposing organic matter. Crop substrates offer ideal conditions for their larvae, which are white and legless, resembling small worms. They feed on organic matter and the tender parts of plants below the ground, such as roots, as well as the stems.

Biological cycle of fungus gnats

Adults live about one week and lay up to 300 eggs in rich, moist soils. Within 4-6 days tiny larvae emerge and begin feeding on plant roots during their two week period. The pupal stage lasts 3-4 days before young adults leave the soil and begin the next generation. The entire life cycle from egg to adult may be completed in as little as 3-4 weeks depending on temperature. Because of their proclivity and relative short gestation, potted plants can host each stage – egg, larvae, pupae, adult – in multiple generations at once. Because of this remedies usually require repeated applications until there are no surviving eggs.

Symptoms of a pest

Plant symptoms that indicate fungal gnats are seen as sudden wilting, loss of vigor, poor growth, and yellowing. With severe infestations, a considerable portion of the plants may be lost.

How to prevent the pest?

• Inspect plants thoroughly prior to purchase for signs of insect pests. Turn up soil carefully near the base of the plant and look for the glossy, clear larvae. Reject any plant sending up flying gnats.

• Fungus gnats do best in damp soils; be careful not to over water, especially during winter months when plants require less water. When potting, avoid organic material that holds water, such as algae, which may encourage egg laying.

Solutions to control the pest

• If pests are present, allow the soil to dry to a depth of one to two inches between waterings. This not only kills larvae and inhibits the development of eggs, it also makes the soil less attractive to egg-laying females.

• Use Yellow Sticky Traps placed horizontally at the soil surface to capture large numbers of egg laying adults. The gnats are attracted to yellow and are easily removed on the trap before they can lay more eggs.

• Top dress houseplants with Beneficial Nematodes to destroy the larvae stage. Nematodes are microscopic round worms that penetrate fungus gnat larvae, as well as harmful lawn and garden grubs, fleas, and other soil-borne pests (they do not harm earthworms). Then release a bacterium that consumes the pest from the inside out. The long-lasting nematodes are safe for use around pets, plants, and your family.

