Plant healthcare Factsheet

Key facts

- A fungal foliar disease spread primarily by airborne spores
- Unrelated to downy mildews
- Common on leaves, but may affect other aerial parts
- Requires living host tissue on which to develop
- Withdraws nutrients from the host, causing loss of yield and quality
- High humidity, but not leaf wetness, needed for infection
- Manipulating the microclimate will help prevent outbreaks
- Protectant and curative fungicides available, as well as some 'alternative' treatments
- Strategies required to prevent the development of fungicide resistance

Fuchsia powdery mildew

Introduction

The white growth of powdery mildews makes them one of the more easily recognised fungal diseases. Whilst powdery mildew will rarely kill a plant, its presence within a crop can soon lead to loss of yield and / or quality.

There are many different species of powdery mildew, but they have a fairly limited host range, often affecting plants from just one family. An individual plant may sometimes be affected by more than one powdery mildew, however (see poinsettia, below).

The majority of the growth of most powdery mildews is present on the surface of the plant, and is therefore readily accessible to control agents such as fungicides. Fungicide resistance is always a threat, however, and a suitable anti-resistance strategy is an essential component of fungicide use against this group of diseases.

Symptoms

Typical powdery mildew symptoms consist of a white or off-white fungal growth on the plant surface. Both leaf surfaces can be affected (although growth is most commonly seen on the upper surface), and the fungus is also sometimes found on stems, flower buds, calyces, petals and fruit. The growth consists of mycelium and asexual spores (conidia). It is usually most powdery when the humidity is high and large numbers of spores are produced, often in chains. When the humidity is lower or the mildew growth is older it can sometimes appear brownish and quite mealy. Some mildews may produce a second, sexual spore type (ascospore) within a brown or black, pinhead-sized body known as a chasmothecium or cleistocarp, which is found amongst the mildew growth (see biology, below).

Leaves of all ages can be affected. Young leaves are often very prone to attack, but in a dense crop the disease may spread upwards from the older leaves, as the humidity at the base of such a crop will be higher. Heavy infection may lead to distortion, yellowing and premature loss of leaves.

There are exceptions to any rule, and some powdery mildews produce atypical symptoms. For example, the growth of rhododendron powdery mildew is usually confined to the lower leaf surface and is often sparse and difficult to see, although there may be yellow or reddish-purple blotching as the plant reacts to the infection. Powdery mildew of young laurel (*Prunus laurocerrasus*) leaves results in severe leaf distortion and yellowing, and affected parts of the leaf may be shed to produce a 'shot-hole' effect. Infection of *Kalanchoe* and some *Sedum* species may lead to a severe host reaction that results in necrotic scarring symptoms not unlike those of a chemical toxicity.

Powdery mildew - conidia

Biology

All of the powdery mildew fungi are obligate biotrophs, meaning that they require living host tissue on which to grow. As mentioned previously, most of the fungal growth is on the surface of the leaf or other plant part. The mildew penetrates the plant cuticle at regular intervals and produces specialised feeding structures called haustoria, which set up an intimate association with the epidermal cells. Nutrients produced by the plant for its own growth are instead diverted via the haustoria into the fungus. A few species of powdery mildew penetrate more deeply into the leaf, but still obtain their nutrients via haustoria.

The asexual spores or conidia of powdery mildews are often produced in huge numbers (many thousands on a single leaf), and are readily dispersed by air currents, water splash, etc. Unlike the spores of other foliar diseases such as downy mildews and rusts they do not require a film of water on the leaf surface to germinate, although periods of high humidity are necessary. Powdery mildew attacks can therefore occur during spells of dry weather, when the progress of many other fungal diseases is checked.

Powdery mildews overwinter in a number of ways, depending on the mildew species and the host plant. Where leaves are present year round, the mildew may survive (and even spread slowly) as mycelium and conidia. Other species may survive on the leaves of related plant genera.

Some mildews survive as mycelium on other parts of the plant, for example on rose stems. An important method of overwintering on many deciduous trees and shrubs is mycelium within the buds - shoots growing from such buds in the spring soon become covered with mildew and are known as 'primaries'. Not all mildews produce the sexual spore type or ascospore, but those that do often produce their chasmothecia containing these spores in response to leaf senescence of the host. The chasmothecia overwinter on the plant, in leaf debris or the soil to produce their ascospores in the spring.

Diagnosis

The symptoms of many powdery mildews are so obvious that they can be diagnosed without the need for a microscope or even a hand lens. In some cases, however, laboratory examination may be required. The mildew symptoms may be atypical (e.g. on *Sedum*) or the disease may be present on a new host plant. It is also sometimes possible to confuse white deposits on the leaf (from pesticides, limescale, etc.) with powdery mildew. There is often confusion as to whether a plant is affected by powdery or downy mildew - it is important to know which disease is present so that the correct control measures can be applied.

In most cases laboratory testing will involve examining preparations from the affected plant under the light microscope, to identify the characteristic spores. Occasionally more complex testing, including electron microscopy and molecular tests, may be required. An example of this more detailed approach is work carried out by CSL into outbreaks of powdery mildew on poinsettias grown from imported material - four different mildew species were identified, of which two are quarantine organisms (http://www.defra.gov.uk/planth/poinset.htm).

Chemical control

There are a large number of fungicides available to growers with activity against powdery mildew. These will vary according to the crop, and are too numerous to list in this factsheet. They range from protectant products, which need to be applied before the disease is present, to fungicides with eradicant activity (although these should still be applied as soon as possible if mildew is found). Many of the more modern fungicides effective against powdery mildew will have little or no activity against downy mildew; hence the need as outlined previously to ensure that the disease is identified correctly.

Because powdery mildews produce huge numbers of spores, there is always the chance of mutations arising, some of which could lead to the development of resistance to previously effective fungicides. An anti-resistance strategy is therefore very important when formulating a fungicide programme. Detailed information is beyond the scope of this leaflet, but can be obtained from the Fungicide Resistance Action Group (FRAG) or downloaded from www.pesticides.gov.uk/rags_home.asp.

Preventative measures

- Reduce humidity. Ventilate crops grown under protection (with heat if required). Increase air movement by the use of fans, adequate spacing, open sites for outdoor crops, etc
- Prevent overwintering of the fungus, by disposing of fallen leaves, pruning out of overwintering mycelium, etc
- Controls weeds that may act as alternative hosts of a powdery mildew
- Monitor crops regularly to identify outbreaks as early as possible
- Dispose of affected material carefully to avoid spreading the spores of the fungus
- Avoid water stress - in some cases mildew outbreaks are worse when the soil or growing medium is too dry
- Avoid the excessive use of nitrogen, or the occurrence of potassium deficiency - both are thought to increase the susceptibility of some plants to powdery mildew attack
- Grow resistant varieties if they are available. Even where plants are not specifically marketed as mildew-resistant, there will often be obvious differences in susceptibility where many different varieties are grown (e.g. bedding plants)

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