Rhubarb downy mildew

This factsheet describes the symptoms of downy mildew (Figure 1) and how it spreads in rhubarb plantations. It provides guidance on disease avoidance and summarises both cultural and chemical control measures.

Figure 1. Early downy mildew symptoms displaying angular yellow lesions on rhubarb leaf

Background

Rhubarb downy mildew (Peronospora jaapiana) has become an increasing problem in the UK. It was first reported in 1980 on Chinese rhubarb (Rheum officinale). In commercial edible harvested rhubarb (Rheum L.) crops, yield reductions of up to 30% have been reported. Severe infection can cause leaf death, reducing photosynthetic ability and subsequent plant vigour and yield the following year. In potted rhubarb plants grown for ornamental production, the leaf spots and subsequently tattered leaves render the crop unsaleable. In cool, humid and wet conditions, the disease can progress rapidly within the dense crop canopy of outdoor crops.

Action points

- Propagate from symptom-free plants
- Maintain weed control and manage irrigation to reduce humidity within the crop
- Consider targeting preventative fungicide applications by monitoring weather conditions favourable for downy mildew
- Be vigilant for early symptoms
- Be aware symptoms can be mistaken for other leaf pathogens therefore microscope confirmation of diagnosis may be beneficial to ensure correct treatment
- Remove infected debris from the field where possible.
Reddening can also occur due to stress, or from physical injury, such as spray damage or high pest infestation. However, these cause a different form of reddening (Figure 4) to that caused by downy mildew. The reddening is more intense with more diffuse edges, and, unlike downy mildew, is not constrained by veins.

Downy mildew can also be confused with Ramularia leaf spot (Ramularia rhei). This leaf spot disease has smaller spots of up to 10–20mm diameter, which can affect both stems (petioles) and leaves (Figures 5a and 5b). Ramularia leaf spots are red-brown and are not delineated by leaf veins. Early stages may appear as small red spots. It is important to distinguish between the two diseases as each is controlled by plant protection products with different active ingredients.

Figure 6 helps to distinguish clearly between downy mildew, reddening caused by stress/injury and Ramularia leaf spot as all three can be found in the plants in the same picture.

Distribution

Downy mildew of rhubarb is caused by the species Peronospora jaapiana. This fungus-like Oomycete pathogen has been responsible for severe attacks in the East of England. The first listed records in the UK are of Chinese rhubarb infection in Cambridgeshire and Norfolk. Recent reports in commercial crops of edible rhubarb crops in the UK have been from Yorkshire, Nottinghamshire, Norfolk, Worcestershire, Surrey and Hampshire. Outside the UK, it has been recorded in gardens in the USA, Poland and Australia. There have been further reports from Asia and across Europe. It is not restricted to commercial vegetable rhubarb. Chinese rhubarb (Rheum officinale and Rheum palmatum), False rhubarb (Rheum rhaponticum) and R. undulatum are also reported as being susceptible.

Life cycle

Despite being initially recorded in Switzerland in 1903 and in the UK in 1980, relatively little is known about this pathogen’s life cycle and the initial source/s of infection. Downy mildews are obligate pathogens and so infection, growth and sporulation require living host tissue. Spores (conidia) are produced on conidiophores that emerge from the lower leaf surface, usually through open stomata, and are dispersed by air currents, water splash or through contact with people and tools. Conidiophores (Figures 7a and 7b) are produced sparsely by P. jaapiana. Conidia are obovoid (28–30 x 14–18µm) and pale violet-brown.
spores are likely to be short lived, should humidity and temperature become unfavourable. Although the thick-walled resting spores (oospores), which allow the pathogen to survive for long periods, have not been found, the survival of fungal mycelium on old plant tissue would explain why infection can re-occur on new plantings in fields previously affected. However, in fields where rhubarb infection has not previously been seen, it would be helpful to understand the distances over which conidia can spread from other locations and remain viable, along with the likelihood of disease movement as mycelium in planting material.

Downy mildew has not been reported on rhubarb grown indoors in the UK in forcing sheds or tunnels. Despite conditions being wet and cool (which would seem favourable for infection), the decrease in leaf canopy reduces humidity. In addition, ventilation is often increased to reduce the occurrence of Botrytis grey mould, the key disease issue in forcing sheds. Both these factors could explain the absence of downy mildew in forcing sheds and tunnels.

**Integrated disease management strategy**

It is important to maintain an integrated approach to the management of downy mildew, to include cultural and biological control measures, in order to reduce the chance of resistance development by the pathogen to the limited chemical control options.

**Cultural control**

The first consideration is to propagate from disease-free plants and, where possible, consider varietal susceptibility. Variations of tolerance to downy mildew have been seen in the Royal Horticultural Society (RHS) national collection of rhubarb varieties at RHS Wisley. However, the main commercial varieties, including Timperley Early, Reeds Early Superb, Victoria, The Sutton, and Livingstone all seem to be affected by downy mildew. Stockbridge Arrow is the only current commercial variety that appears to have some tolerance to downy mildew.
Control of environmental conditions favourable to disease development should be exercised, where possible. Rhubarb canopies are naturally dense and vigorous in healthy plantations, but wider plant spacing and effective weed control can be utilised to improve ventilation between plants (Figure 8). Humidity can be reduced by the avoidance of overhead irrigation. If this has to be applied, it should be applied earlier in the day to provide sufficient daylight for the leaves to dry.

Infected leaf debris should be removed from the field where possible, and sensible crop rotations implemented with a break between rhubarb cropping.

**Biological and chemical control**

Fubol Gold WG (metalaxyl-M + mancozeb), is the only crop protection product currently approved (EAMU 2283/13) for use on outdoor rhubarb, which is known to be effective against downy mildew. Care must be taken with its use to prevent the development of pathogen resistance, especially as resistance to metalaxyl-M has occurred in downy mildews specific to other crops.

Ideally, Fubol Gold WG should be applied before symptoms are seen, as it offers protection rather than curative properties. Three applications are permitted per year, used at least seven days apart and up to 21 days before harvest. Monitor for cool, wet and humid weather conditions that may be conducive to downy mildew and consider applying a fungicide if these conditions occur, especially if early symptoms are seen in the crop.

Plover (difenoconazole) also has an EAMU (2786/15) for use in outdoor rhubarb but its activity is primarily against leaf spots and with only one application permitted per season, this fungicide should be targeted towards the control of Ramularia leaf spot.

The biofungicides Serenade ASO (Bacillus subtilis) and Prestop (Gliocladium catenulatum) are also approved for use on rhubarb under EAMU approvals 0706/13 and 2773/15, respectively, but although these products have efficacy against other Oomycete pathogens (those causing Phytophthora root rots), they are not proven to control downy mildews.

**Future considerations**

There are many gaps in our knowledge of this pathogen and more work is required to understand the lifecycle to enable the development of effective control strategies. It is important to determine if the infection becomes systemic, due to the perennial nature of the crop and the potential influence of infection on yield in subsequent years. Systemic and/or non-symptomatic infection would be an important consideration in vegetative propagation.

It is important to maintain an integrated approach to management because chemical control of the disease currently relies on one active ingredient to which resistance has developed in other crops. Varietal tolerance requires further investigation for use as part of integrated disease management.

**Further information**

**Useful AHDB project reports**

CP 157 – Aerial Oomycetes: A review of management and control options available for the UK horticulture industry.

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