



DOWNY MILDEW OF BASIL

Downy mildew of basil, caused by the oomycete pathogen *Peronospora belbahrii*, is a devastating disease of basil. Complete crop loss occur, if the disease is not controlled. It was first reported in Florida in 2007 and was observed in Illinois in 2009. Since 2009, downy mildew occurred in Illinois and most of the other basil growing areas of the United States (US) every year. Downy mildew had been reported in Uganda in 1933, Switzerland in 2001, Italy in 2003, and Belgium and France in 2004. *P. belbahrii* can be seedborne and distributing contaminated seed is a plausible way of spreading the pathogen in the world. Recently, downy mildew of basil has been reported from basil growing areas in Africa, Asia, Australia, Europe, and North and South Americas.



Figure 1. Basil plants with downy mildew.
Note leaf chlorosis.

SYMPTOMS

Downy mildew affects leaves of basil plants. Leaves develop yellowing or browning areas on the upper sides of the leaves (Figures 1 and 2). The surface of infected areas on the underside of the leaves are covered with profuse, dark sporulation of the pathogen (Figure 3). Usually, the sporulation is obvious enough that it can be seen without a microscope or hand lens, however, a closer look at the sporulation on the leaf with a hand lens or dissecting microscope, the typical sporangiophore structures bearing sporangia can be seen (Figure 3), which are typical signs of downy mildew pathogens. Leaves with yellowing resembling downy mildew but lacking spores can be placed upside down on wet paper towel in a closed plastic bag in dark for a day to encourage the pathogen if present to produce spores.

DISEASE CYCLES

Peronospora belbahrii can be carried on seed, transplants, or fresh leaves. Infected transplants and leaves may not show symptoms if maintained in cool dry conditions. Spores of *P. belbahrii* can also

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be transported long distances on moist air currents. High-humidity and moisture and cool temperatures are conducive for development of basil downy mildew. *P. belbahrii* can infect plants and produce spores in temperatures as low as 59°F (15°C). In Illinois, the disease begins in late May or June and lasts throughout the growing season, until the middle of October. The most devastating damage is often seen in late summer.

Peronospora belbahrii is an obligate parasite which means that it survives in infected plant tissues. The pathogen may overwinter as oospores (thick-walled resting spores) in the absence of host plants, but it needs two different mating types to produce oospores. Only one mating type of the pathogen has been found in the US. As a result no oospores are formed and the pathogen will not be able to survive in the fields in Illinois in winter. This may change if the second mating type of the pathogen is introduced



Figure 2. Basil leaves with downy mildew showing yellowing of the upper surfaces.

DISEASE MANAGEMENT

Using pathogen-free seed, selecting less susceptible cultivars, minimizing leaf wetness, and application of fungicides are the primary management practices for control of downy mildew of basil. Seeds should be purchased from a reliable source and certified. Seeds also can be tested for presence of *P. belbahrii*.

All sweet basil (*Ocimum basilicum*) cultivars have been reported susceptible to downy mildew. Some of the exotic, spice, and ornamental basil species such as *Ocimum citriodorum* and *Ocimum americanum* have been found resistant or less susceptible to downy mildew.

Minimizing leaf wetness and reducing humidity to obtain conditions unfavorable for disease development may suppress downy mildew, especially in greenhouses.



Figure 3. Downy mildew of basil. A, the lower surface of a leaf with the sporulating pathogen; B, a close up of the sporulating pathogen; and C, a sporangiophore with sporangia.

Effective fungicide for control of downy mildew of basil are available. But to control downy mildew effectively with fungicides, it is necessary to start fungicide application before or at the first symptoms of the disease and make applications at weekly intervals. More than 10 biocontrol agents have been tested for their efficacy for control of downy mildew of basil in Illinois and none of them provided satisfactory protection of the plants against the disease. In contrast, several fungicides were found highly effective for control of downy mildew of basil in conventional production in Illinois. But only the following fungicides have been registered: Ranman (cyazofamid, FRAC 21); Revus (mandipropamid, FRAC 40), Quadris (azoxystrobin, FRAC 11), and ProPhyt (phosphorous acid fungicides, FRAC 33). Application of ProPhyt alone does not provide effective protection of basil plants against downy mildew, but application of either Ranman, Revus, or Quadris alone or mixed with ProPhyt effectively controls the disease. In Illinois, up to 14 spray-applications of fungicides maybe needed to provide season-long protection of basil plants against downy mildew. According to the labels, Ranman, Revus, and Quadris can be spray-applied 4, 4, and 6 times per season, respectively, thus the use of these fungicides will provide season-long protection of basil plants against downy mildew in Illinois. Fungicide recommendations should be strictly followed.