

DOWNY MILDEW OF BRACCICAS

Downy mildew, caused by *Hyaloperospora parasitica*, occurs worldwide, where brassica crops are grown. Downy mildew is common on Brussel sprouts, broccoli, cabbage, Chinese cabbage, cauliflower, kohlrabi, marrow-stem kale, turnip, turnip rape, oilseed rape, rutabaga, brown mustard, black mustard, and Abyssinian mustard. Host age affect the extend and severity of infection. Young seedlings are more likely to become infected and to die. Infection at later growth stages is generally not so severe but reduces yield and quality.

Symptoms

Although all aerial parts of host plants may become infected, symptoms of downy mildew appear primarily on leaves and inflorescences. Infection of cotyledons results in development of necrotic lesions. Infection of true leaves results in the development of small, angular lesions, which later enlarge and develop into irregular orange or yellow necrotic patches (Figure 1). Sporangiohores (conidiophores) and sporangia (conidia) develop on the underside of leaves (Figure 2), which is important for diagnosis of downy mildew.

The pathogen also infects the curds of cauliflower (Figure 3) and broccoli (Figure 4), and cabbage heads both in the



Figure 1. Orange and yellow necrotic leaf spots of downy mildew on cauliflower (Courtesy APS, B. Dahl Jensen).



Figure 2. Sporulation of *Hyaloperonospora parasitica* on the underside of a broccoli leaf (Courtesy APS, R. H. Morrison).

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field and in storage. A pale brown or grayish discoloration appears on the surface of the curd or head, and grayish or black spots and streaks develop on the stem. Sporulation may be visible on the curd or head surface, or it may develop after incubation under humid conditions.

Disease cycle

H. parasitica is an obligate parasite. The pathogen produces sporangiophores (conidiophores) and sporangia (conidia). Conidiophores are produced singly or in groups. Conidia are hyaline and spherical at first but later become ellipsoidal. *H. parasitica* also produces sexual spores (oospores). Mature oospores are thick walled, yellow-brown, and spherical. Oospores are produced in plant residues and can be carried on the seeds.

Seedlings can be infected from oospores from plant residues or on seed. In temperate climates, *H. parasitica* overwinters on winter-sown crops or survives between seasons in other biennial or perennial crucifer hosts. Infection of leaves and other aerial plant parts occurs from airborne sporangia (conidia) produced on living host plant tissues. After infection and a period of vegetative growth, conidiophores emerge through stomata to produce conidia. These conidia are a source of secondary spread and infection. Usually, leaves are infected by wind-borne conidia. Conidia survive for only a few days on leaves under typical field conditions. The disease is most prevalent under cool, moist conditions. Temperature around 15°C (60°F) is most favorable for development and epidemic of downy mildew.

Disease management

- Plant pathogen-free seed and disease-free transplants.
- Plant resistant cultivars, wherever are available.
- Practice two years or longer of crop rotation with non-crucifer crops to reduce severity of the disease.
- Avoid planting seedbeds near plantings of other crucifer crops or near cull piles to reduce the risk of infecting the seedlings.
- Control weeds and volunteer crucifer plants.



Figure 3. Brownish internal symptoms of downy mildew on cauliflower curd (Courtesy APS, B. Dahl Jensen).



Figure 4. Brown internal symptoms of downy mildew on broccoli inflorescences (Courtesy APS, R. H. Morrison).

- Reduce moisture on plants, especially in seedbeds. Consider more space between plant. Avoid the use of overhead irrigation.
- Remove crop debris to prevent inoculum build up.
- Avoid poorly-drained soils.
- Chemicals Actigard, Quadris, chlorothalonil (e.g., Bravo), Forum, Orondis Opti, Orondis Ultra, Phosphites (e.g., ProPhyt), Presidio, Ranman, Reason, Revus, Ridomil Gold Bravo, and Zampro have been registered for managing downy mildew of brassicas. For the up-to-date information on using chemicals for managing downy mildew of brassicas, refer to the Midwest Vegetable Production Guide for Commercial Growers (<https://mwvegguide.org/uploads/pdfs/2022-Midwest-Veg-Guide-8.5-x-11-with-covers-no-bleeds-bookmarked-compressed.pdf>).

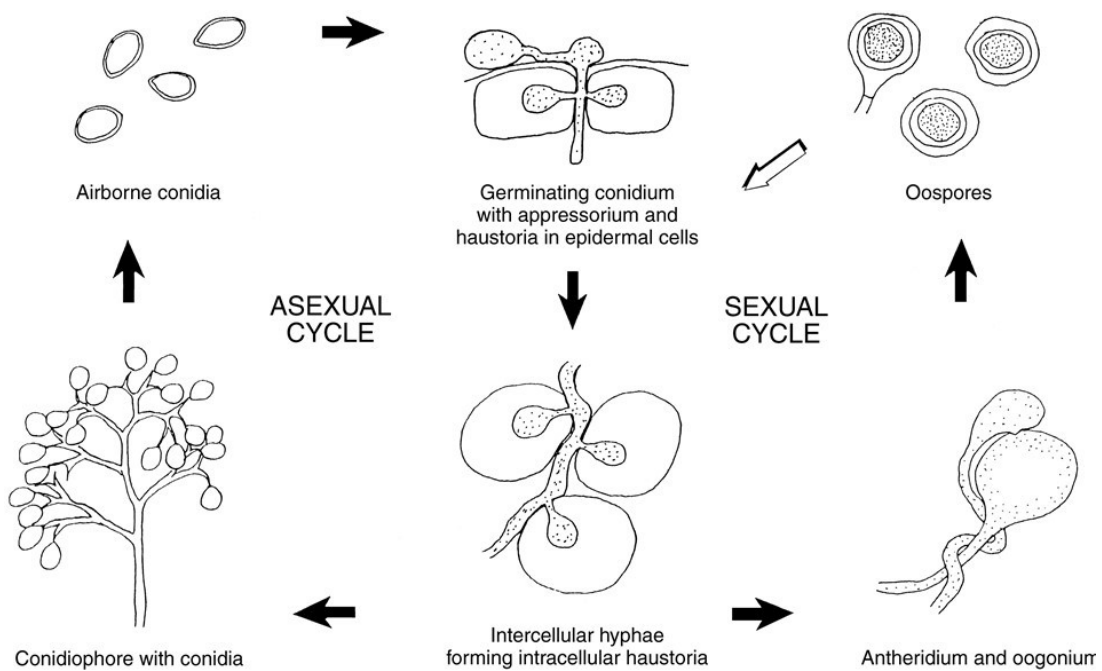


Figure 5. Life cycle of *Hyaloperonospora parasitica* on brassicas (Courtesy APS, Reprint from Elsevier Science Ltd.).