

Hop Powdery Mildew

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(HPM), a serious fungal disease of hops was recently detected at several commercial hop yards in the Northern Willamette Valley. This detection, made in late July 1998, is the first confirmed report of HPM in a commercial hop yard in Oregon. This disease has the potential to be extremely damaging to hop yields and is a threat to commercial hop growers, hop enthusiasts and the brewing industry.

After the dramatic HPM outbreak in the Yakima Valley in 1997, Idaho and Oregon were the only two areas of commercial hop production that remained free of this aggressive pathogen. But now with the detections of HPM near Parma and Bonner's Ferry, ID, and the detections in Marion County, Oregon, the pathogen has spread to all U.S. hop production regions.

The Fungus

Some mycologists classify this powdery mildew as a race of *Sphaerotheca macularis*, the same species that attacks a wide variety of horticultural and ornamental plant species. Others consider this to be *S. humuli* and specific to hops. Whatever the correct scientific name, this pathogen, in combination with downy mildew, caused the failure of the eastern U.S. hop industry in the early 1900s

and continues to be a major problem in England and Europe.

Hosts

HPM attacks a wide variety of commercial hop cultivars as well as ornamental and wild populations of *Humulus lupulus* (Hop). Attempts to inoculate other agronomic species and common weeds have not been successful. While some hop varieties verge on being resistant, most varieties support at least some level of HPM reproduction. Some of the most susceptible varieties include Galena, Chelan, Tillicum, Symphony and Northern Brewer. Those with some degree of resistance to this race of HPM

include Nugget, Cascade and Mt. Hood. Other varieties should fall in between these two ends of the susceptibility range. It should be noted that these rankings are based on a single season's observations and with likely only one race of HPM. Changes in susceptibility can be expected by annual weather fluctuation, the amount of pathogens present and by other races of HPM.

Symptoms

The fungus first appears as small, circular, powdery colonies on the leaves of hops (photo). Young and rapidly growing tissue is very susceptible to infection by HPM.



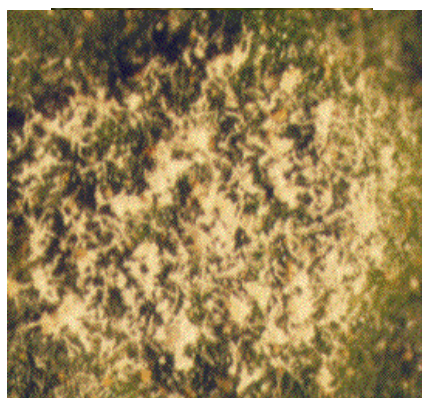
White to silver-gray colonies of hop powdery mildew on the leaves of commercial hop plants become numerous by mid-summer. These colonies will enlarge and produce more spores that can spread to other young leaves and cones and eventually turn entire leaves white with their powdery mass.

As the disease progresses, the colony size increases from about a sixteenth of an inch, to a half an inch or larger. More colonies appear on the leaf surface and may eventually turn the leaf and occasionally the entire vine white. Infection of the female flower (or burr) is the most serious form of the disease. If the burr is infected early in its growth, the female flower or cone may not develop at all, or may become deformed and brittle. For susceptible varieties under severe disease pressure, yields can drop by 80% or more, even with the application of fungicides.

Disease Movement

The disease spreads primarily by air-borne spores called conidia. These spores are released from the fungal colonies and are carried by wind currents for many miles. Free water is not required for conidial infection, but high humidity and temperatures between 55 and 90 F favors both conidial germination and subsequent spore production. New infections can produce conidia in as little as 96 hours, but large amounts of conidia may not be produced from colonies for up to two weeks.

HPM can also be distributed by infected rhizomes (roots) where it lies dormant and nearly undetectable, either as mycelia or as cleistothecia (overwintering spores). HPM can also be moved on infected soft-wood cuttings, infected raw cones and plant debris and on tools and equipment.



Magnified lesion (40X) showing the powdery and non-uniform appearance of HPM.

Exclusion and Control

All three states with commercial hop production maintain quarantines prohibiting the importation of hop plants, rhizomes and cuttings. The USDA also maintains a Federal quarantine which regulates the foreign importation of hop plants and rhizomes. Until very recently, control had been achieved by exclusion. Now that HPM is present in the Pacific Northwest, all hop growers, **including non-commercial growers** should consider a range of actions including:



HPM damage on hop cones. Note the stunted size of cones that were infected when they were young flowers (arrowed).

✓ **Removing all highly susceptible varieties and re-planting only resistant varieties.**

✓ **Roguing out all off-type or unidentified hops as their susceptibility is unknown.**

✓ **Destroying all feral or escaped hops in the production areas.**

✓ **Plowing out aerial buds in the early spring to reduce overwintering inoculum.**

✓ **Applying registered fungicides to all varieties per the label**

✓ **Composting or kiln-drying all hop leaf and vine material before returning it to the yard for plowing.**

✓ **Removing or plowing all diseased material that remains in the yard after harvest.**

Please contact your Horticulturist or Extension Agent for current spray recommendations and the ODA Plant Division for issues relating to quarantines or disease identification at the number below.

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