

**FUNGAL DISEASES OF APPLE:
POWDERY MILDEW AND COLLAR ROT**

**(ENFERMEDADES FUNGOSAS DEL MANZANO:
CENICILLA Y PUDRICIÓN DE CUELLO)**

**S. KRISHNA MOHAN
Plant Pathologist
University of Idaho, Parma, ID 83660
U.S.A.**

Apple is subject to a multitude of diseases caused by fungi, bacteria, phytoplasmas, viruses and nematodes. Any of the above ground parts (trunk, branches, leaves, flowers and fruits), below ground root system, as well as fruits after harvest, are targets for attack by these pathogenic agents, and the damage caused is dependent on the specific disease, susceptibility of the variety, and cultural and environmental conditions. A vast majority of the diseases in apple are caused by fungi. Of these fungal diseases, **powdery mildew** and **collar rot** are of major economic importance in several apple growing regions.

Powdery Mildew (Cenicilla, Oídio)

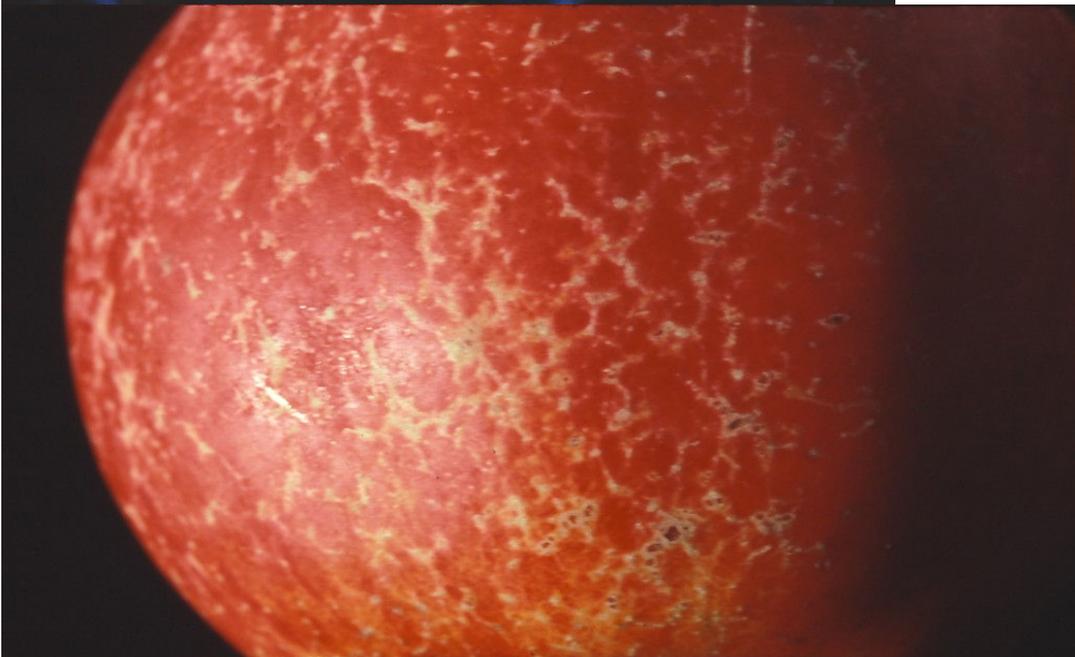
Powdery mildew occurs in all the regions where apples are grown. Severity of the disease and the extent of economic losses depend on the climatic conditions of the growing region, susceptibility of the varieties, and management practices used in the orchard or nursery. Powdery mildew is an economically important problem on young trees in the nurseries. In certain apple growing regions, powdery mildew is known to cause net-like russetting of fruit surface and thus reduce the market value of the fruit.

Presented at the XII Simposium Internacional 2006 Sobre el Manzano, Cd. Cuauhtémoc, Chihuahua, México, November 10, 2006.

Symptoms: Powdery mildew can infect apple leaves, buds, twigs and fruits.



Dormant, overwintering shoots that were heavily infected during the previous growing season, are covered with dense white mass of mycelium, and the terminal bud may be shriveled. New terminal growth is particularly susceptible to powdery mildew. The leaves show gray or whitish patches of mycelium and spores on both upper and lower surfaces, and these powdery masses may cover the entire leaf surface. Severely infected leaves are narrow, and may be curled or longitudinally folded. Infected terminals are stunted with short internodes, and are covered with a white mat of mycelium. As the season progresses, the mycelium turns brownish and becomes embedded with minute, brown, fruiting bodies of the fungus. Infected flower parts are also covered with white, powdery growth of the fungus, and may dry out without setting fruit. Early fruit infections can lead to russetting of the fruit skin.



Economic damage occurs in the form of aborted blossoms, reduced vigor and yield of bearing trees, reduced fruit finish, and stunting and poor form of young, non-bearing trees.

Causal Organism and Biology: Powdery mildew is caused by the fungus *Podosphaera leucotricha*, which also infects crabapple, pear and quince. The fungus overwinters as mycelium in dormant buds. Conidia (spores) are produced and released from the unfolding leaves and are easily dispersed by wind. Conidia germinate in high relative

humidity at an optimum temperature of 19-22° C. Germination does not occur in free moisture. Abundant sporulation from overwintering shoots and secondary lesions on young foliage leads to a rapid buildup of inoculum. Leaves are most susceptible soon after emergence.

Management: Powdery mildew may be reduced by removing infected buds during pruning so as to eliminate the sources of primary inoculum. However, a series of spring and summer sprays are needed to prevent leaf, fruit and terminal bud infection. A wide range of products, some with protectant action and others with systemic activity, including sulfur-based products, demethylation-inhibiting (DMI-type) products, bicarbonates, benzimidazoles and biological agents, are available. **Consult your local farm adviser or technical representative, and always follow the pesticide label directions.** Periodic spraying from pink bud until the end of terminal growth is needed to protect the susceptible tissues. Appropriate timing and frequency of spraying are very critical. Plant resistant varieties and avoid highly susceptible varieties. Some very susceptible varieties: Jonathan, Rome, Granny Smith, Gravenstein, and Braeburn. Less susceptible varieties include Red Delicious, Spur Delicious, Golden Delicious, and Liberty.

Collar Rot (Pudrición de Cuello)

Collar rot (affecting the scion portion), crown rot (affecting the rootstock portion) and root rots are serious diseases of apple (and other orchard trees), especially on certain highly susceptible clonal rootstocks. These diseases occur in almost all the apple growing regions and may cause significant losses depending on the rootstock and scion varieties, soil type, planting, irrigation and other management practices.

Symptoms: Crown and collar rot affected trees show poor terminal growth, sparse foliage, reduced leaf size, and are stunted. They show premature discoloration of leaves in early fall, with bronzing, purpling or yellowing of foliage. Infected trees decline slowly over several seasons, or occasionally may collapse and die suddenly.



Examination of the crown or collar region shows dead bark and the tissues below it are necrotic, orange-brown to reddish-brown, later turning to dark brown in color, in contrast to the white healthy tissue.



In advanced stages, the trunk may be completely girdled. Symptoms on the rootstock and the graft union may be similar to those caused by fire blight.

Causal Organism & Biology: *Phytophthora cactorum* and other species of *Phytophthora*, which are fungus-like microorganisms. These are soilborne (live in soil) organisms and survive long periods (several years) in soil as oospores, which are their sexual resting spores. In wet (saturated or nearly saturated) soils, these oospores

germinate and produce the swimming zoospores which cause infection. Some of these *Phytophthora* species have a wide host range including several native and cultivated plants. The primary inoculum may, therefore, be already present in some soils, or it may be introduced into an orchard site through contaminated nursery stock or contaminated irrigation water. The fungal mycelium and oospores persist in infected tissue, or as oospores in the organic debris or soil.

Management: Integrated management of collar and crown rot should include cultural practices, resistant varieties, and fungicide applications. Among the cultural practices, planting site selection and irrigation management are critical to prevent losses. Trees should be planted only where the soil is well drained, and on raised beds to avoid accumulation of water around the trunk. Avoid overirrigation to prevent occurrence of extended periods of soil saturation. Avoid causing wounds on the crown/collar region of the trunk. Rootstocks MM104 and MM106 are very susceptible; MM111, M2, M7 and M26 are moderately resistant; and M9 and some apple seedlings are highly resistant to collar rot. Several chemical treatment options are available, including mefenoxam, copper-based products, phosphorous acid, and fosetyl-Al. **Consult your local farm adviser or technical representative, and always follow the pesticide label directions.** Treatments are more effective if made preventatively, especially in orchards that have conditions favorable for disease incidence.