

Lecture 16 - Diseases of Onion & Garlic

Basal Rot: *Fusarium oxysporum* f.sp. *cepae*

Symptoms



The leaves turn yellow and then dry up slowly. The affected plant shows drying of leaf tip downwards. The entire plant shows complete drying of the foliage. The bulb of the affected plant shows soft rotting and the roots get rotted. There will be a whitish mouldy growth on the scale. This disease can begin in the field and continue on in storage.

Pathogen

The fungus produces many chlamydospores which are thick walled resting spores and microconidia which are one celled and thin walled.

Mode of spread and survival

The pathogen is soil borne and the optimum temperatures for development are 28 - 32°C. Infection occurs through the root either directly or through wounds.

Management

Growers must follow crop rotation and harvested bulbs must be thoroughly cured to reduce potential storage losses. Onions are very sensitive to low soil copper levels. In order to optimize crop production and disease susceptibility, additional soil copper fertility may be needed especially on mucky and sandy soils. Soil drenching with Copper oxychloride 0.25 %.

Downy mildew: *Peronospora destructor*

Symptoms



White downy growth appears on the surface of the leaves. Finally the infected leaves are dried up.

Pathogen

The sporangiophores are non septate, long and swollen at the base. Sporangia are pyriform to fusiform, attached to the sterigmata by their pointed end. These sporangia germinate by one or two germ tubes. The coenocytic mycelium is intercellular with filamentous haustoria. Oogonia are formed in the intercellular spaces.

Mode of spread and survival

The fungus attacks the seed stalks in a seed crop and has been found on and in the seed as mycelium but true seeds do not help in carry over of the fungus from one season to the next. The main sources of perennation are the diseased bulbs used for propagating the crop in many areas and oospores present in diseased crop residues. If infected bulbs are planted, the fungus grows up with the foliage produces sporangia and these spread the disease to other plants.

Disease Cycle

Dormant Period

It is believed that the DM fungus over winters primarily as mycelium in infected onions that remain in onion fields or in nearby cull piles. The pathogen also can over winter in perennial varieties of onion in home gardens. It is suspected that spores of the fungus that persist in the soil may directly infect the roots of young onion plants. These plants become systemically infected and serve as focal points for infection in commercial onion fields.

Primary Spread

When favorable environmental conditions occur, the over wintering fungal mycelium in systemically infected plants produces spores. After dissemination through the air, these spores infect the leaves of onion plants in commercial fields. Spores are formed at night when high humidity and temperatures of 4–25°C occur, with an optimal temperature of 13°C. The spores mature early in the morning and are disseminated during the day. Spores remain viable for about 4 days. Germination occurs in free water from 1–28°C with an optimal range of 7–16°C. Rain is not needed for infection if heavy dews occur continuously during the night and morning hours.

Secondary Spread

The mycelium of DM in leaves of infected onion plants in commercial bulb production fields produces a new crop of spores called conidia in cycles of approximately 11–15 days. As the upper portions of a leaf are killed, the fungus infects the next lower part of the leaf in each successive cycle of spore formation. Such cycles can be repeated several times until the leaf may

be completely killed. These repeated cycles of spore formation can result in severe and continued epidemics of DM if disease favorable environmental conditions persist.

Management

Three spraying with Mancozeb 0.2 % is effective. Spraying should be started 20 days after transplanting and repeated at 10-12 days interval.

Leaf Blight (Blast): *Botrytis* spp.

Symptoms

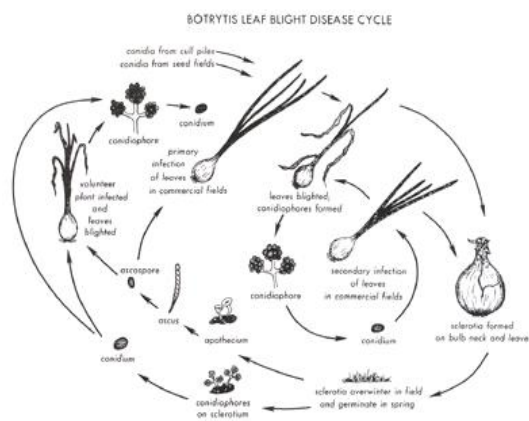


Botrytis is the major disease of onions in cool climate areas. Light infections do not affect yields but heavy infections causing major yield reductions can occur. Hundreds of white specks are seen on the foliage. The disease then spreads very rapidly and tops of the entire crop may be killed.

Pathogen

Botrytis is characterized by its conidiophores which present an appearance of grapebunch. The conidiophores are tall, erect and branches irregularly or dichotomously. They are dark and septate. The terminal cells swell to produce sporogenous ampullae. On each ampulla numerous conidia arise simultaneously on short denticles. The conidia are hyaline or tinted, aseptate and globose to ovoid.

Disease cycle



Dormant Period

The *Botrytis* leaf blight pathogen over winters as sclerotic (compact mass of fungi capable of surviving unfavorable environmental conditions). These are produced on infected onion bulbs left in cull piles, on mother bulbs stored for seed production, and on bulbs left in the field. The latter results in volunteer onion plants the following spring. Sclerotic also over winter directly in the soil and on leaves that persist as debris in commercial onion fields. The sclerotia are formed on infected leaves and the necks and upper portions of bulbs before or after harvest. Infected leaves may be raked or washed together and persist as leaf tissue debris in which many sclerotic can be found. Sclerotic in the soil result from the disintegration and decay of infected leaves on which sclerotic were formed.

Primary Spread

Sclerotic on onion bulbs in cull piles, on mother bulbs in seed fields, and on volunteer onion plants in commercial onion fields produce conidia (spores) that infect leaves on sprouted bulbs and onion plants in commercial fields. Sclerotic on the surface of the soil in commercial onion fields also produce conidia that can infect the leaves of nearby onion plants. Sclerotia on leaf debris produce conidia and also ascospores (sexual spores) that infect leaves of onion plants. Because ascospores are the result of sexual reproduction, they may serve as the source of new strains of the pathogen that are tolerant to fungicides used to control *Botrytis* leaf blight. The ability of sclerotic to germinate and produce conidia repeatedly (up to four times) results in the production of conidia over an extended period of time. Sclerotic on the bulbs of volunteer onions produce conidia that infect either leaves of the same plant or those of onion plants in commercial fields. In the absence of seed fields and cull piles, it is suspected that sclerotic in the soil and sclerotic on volunteer plants provide the primary source of inoculum for outbreaks of *Botrytis* leaf blight in commercial onion fields.

Secondary Spread

The dense, tangled growth of leaves that develop from bulbs in cull piles provides conditions (little air movement and high relative humidity) that are favorable for subsequent production of spores on dead leaf tissue. This results in secondary cycles of infection in the cull piles. Similar secondary cycles occur slightly later in seed fields. Conidia are blown from the seed fields and cull piles to commercial bulb production fields and the disease cycles continue.

Leaves of onion plants in commercial fields can be infected by conidia that develop from sclerotic in the soil.

These infected leaves also serve as secondary sources of inoculum once conidia are produced on the dead leaf tissue. Leaves of volunteer onion plants infected by conidia produced by sclerotic on the same plant also serve as a secondary source of inoculum. Leaves of onion plants grown for commercial production are repeatedly infected, and these serve as the source of inoculum for infecting new leaves throughout the growing season.

Management

Bulb treatment with Captan /Thiram 0.25%. Spraying of Maneb or Mancozeb or Chlorothalonil. Fungicides may be applied every 5 - 7 days for disease control.

Pythium root rot: *Pythium aphanidermatum*, *P. debaryanum* and *P. ultimum*

Symptoms

This disease causes seed rotting, pre-emergence damping off. The disease appears in circular patches in the field here and there. All the affected plants get killed. If the disease occurs prior to seed germination, it causes gappiness. The seeds or seed materials are killed before their establishment. The disease also occurs after establishment of the crop *i.e* after 15 to 30 days of sowing or planting. This stage is called post-emergence damping off. If the disease occurs very late, it causes stunting of the plant and rotting of the roots.

Pathogen

Pythium aphanidermatum

Epidemiology

The fungus is mainly soil borne. The disease is favoured by ill drained conditions in the field due to stagnation of water. High soil moisture or continuous rain may favour rapid development of the disease.

Management

Seed treatment with Thiram or Captan @ 4g/kg. The bulbs may be dipped in Thiram solution 0.25%. After sprouting, the root region of the plants along the rows should be given a soil drenching with Copper oxychloride 0.25%.

Smut: *Urocystis cepulae*

Symptoms



Black smut sori are seen at the base of the leaves and leaf surface. Black powdery mass is seen after rupturing of sorus wall.

Pathogen

The sori of *Urocystis cepulae* contain dark coloured and powdery spore masses. The spores are found in permanent balls. Each ball consists of an enveloping cortex of thin, sterile, bladder like cells with one or two central dark coloured thick walled chlamydospores. The spores germinate by means of short promycelium while still in the ball.

Mode of spread and survival

The fungus remains viable for 15 years in infected soil by means of spore balls. It persists in soil as a saprophyte. Onion bulbs and onion transplants are important means of widespread distribution of the fungus. Implements also help in the spread. Wind borne soil and surface drainage water are important means of local dissemination.

Management

Seed treatment with Thiram or Captan @ 4g/kg. The bulbs may be dipped in Thiram solution 0.25%.

White Rot: *Sclerotium cepivorum*

Symptoms



The leaves become yellow and die-back and when the plants are pulled up, roots are found to be rotten and the base of the bulb covered with a white or grey fungal growth. Later, numerous small black spherical sclerotia are produced. The bulb of the onion completely rots.

Mode of spread and survival

The disease is worst in warm summers or in the case of winter onions during warm spell in autumn or spring. Sclerotia persist in soil for eight years. The primary inoculum consists of spherical small black sclerotia produced in infested fissure of *Allium* spp. during previous years. Sclerotia are transported from field to field by flood water.

Disease Cycle

The sclerotia that form on the decaying host will lay dormant until a host plant's root exudates stimulate germination, specifically root exudates that are unique to *Allium* spp. Cool weather is also needed for germination of sclerotia and hyphal growth. The soil moisture levels optimal for host root growth are also optimal for sclerotia germination. Mycelium will grow through the soil, and once it encounters a host root the fungus will form appresoria, structures whose purpose is to aid in the attachment and penetration of the host.

Mycelium can grow outwards from the roots of one plant to the roots of a neighboring plant, and it is by this method that the pathogen can move down a planted row. Sclerotia are formed on the decaying host tissue, and once the host tissue completely decays the sclerotia are free in soil. If the bulbs survive long enough to be placed into storage, the pathogen may continue to decay the bulbs if there is high humidity and low temperatures. If the bulbs are stored dry then the disease may not spread but bulbs infected in the field will continue to decay.

Management

Crop rotation and clean seed are the only effective control. Heavy manuring with organic manures reduces the disease in the crop. Seed dressing with Benomyl, Carbendazim or Thiophanate-methyl (100 to 150 g/kg seed) gives effective control.

Purple blotch: *Alternaria porri*

Symptoms

This disease occurs mainly at the top of the leaves, the infection starts with whitish minute dots on the leaves with irregular chlorotic areas on tip portion of the leaves. Circular to oblong concentric black velvety rings appear in the chlorotic area. The lesions develop towards the base of the leaf. The spots join together and spread quickly to the entire leaf area. The leaves gradually die from the tip downwards.



Pathogen

Alternaria porri mycelium is branched, coloured and septate. Conidiophores arise singly or in groups. They are straight or flexuous, sometimes geniculate.

Management

Disease free bulb should be selected for planting. Seeds should be treated with Thiram @ 4 g/kg seed. The field should be well drained. Three foliar sprayings with Copper oxychloride 0.25 % or Chlorothalonil 0.2 % or Zineb 0.2 % or Mancozeb 0.2 %.

Neck Rot :*Botrytis allii*, *B. squamosa* and *B. cinerea*

Symptoms



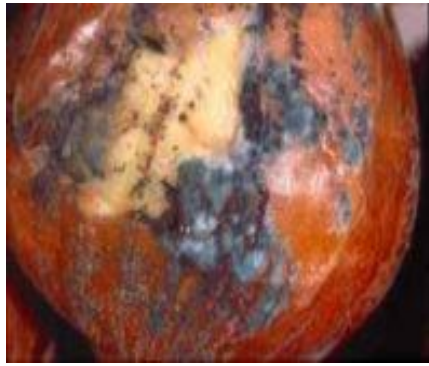
Symptoms usually appear after harvest, although infections originate in the field. Greatest epidemic development occurs when cool (50° to 75°F), moist weather prevails for some days before or during harvest. If the weather remains dry during harvest and curing, losses found in storage are usually small. Symptoms are first seen as a softening of the tissues around the neck of the bulb, or more rarely, at a wound. A definite margin separates diseased and healthy tissues. Infected tissues become sunken, soft, and appear brownish to grayish in color, as if they had been cooked. These symptoms progress gradually to the base of the bulb. Then the entire bulb may become mummified. Hard, irregularly shaped kernel-like bodies, sclerotia, may form between scales, especially at the neck region.

Mode of spread and survival

The fungi that cause neck rot survive the winter on previously infected onion debris in the soil, in cull piles and refuse dumps, and in trash in storage sheds.

Blue mould rot- *Penicillium* sp

Symptoms



Blue mold generally appears during harvesting and storage. Initial symptoms include water soaked areas on the outer surface of scales. Later, a green to blue green, powdery mold may develop on the surface of the lesions. Infected areas of fleshy scales are tan or gray when cut. In advanced stages, infected bulbs may disintegrate into a watery rot. Many species of *Penicillium* can cause blue mold. These fungi are common saprophytes on plant debris and senescent plant tissue.

Pathogen

Penicillium produces an enormous number of spores on a broom like conidiophore. Some of these spores are in the air at all times. They can be carried to long distances by wind. In moist air they germinate readily. Symptoms develop slowly on the bulbs.

Mode of spread and survival

Invasion of onion bulbs and garlic is usually through wounds, bruises, or uncured neck tissue. Once inside the bulb, the mycelium grows through the fleshy scales, eventually sporulating profusely on the surface of lesions and wounds. Optimum conditions include moderate temperatures 70° to 77°F (21° to 25°C) and high relative humidity.

Black mould- *Aspergillus niger*

Symptoms



Infection usually is through neck tissues as foliage dies down at maturity. Infected bulbs are discolored black around the neck, and affected scales shrivel. Masses of powdery black

spores generally are arranged as streaks along veins on and between outer dry scales. Infection may advance from the neck into the central fleshy scales. In advanced disease stages, the entire bulb surface turns black, and secondary bacterial soft rot may make the bulb soft and mushy. No external symptoms may be found with some bulbs.

Management

Seeds should be treated with Thiram @ 4 g/kg seed. The field should be well drained. Three foliar sprayings with Copper oxychloride 0.25 % or Chlorothalonil 0.2 % or Zineb 0.2 % or Mancozeb 0.2 %. Growers must follow crop rotation and harvested bulbs must be thoroughly cured to reduce potential storage losses. Soil drenching with Copper oxychloride 0.25 %