

Disease Management of Cole Crops

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Cole crops are important cool-season vegetable crops belonging to the *Brassicaceae* (*Cruciferae*) family. The group includes cabbage cauliflower (*B. oleracea* var. *botrytis*), (*Brassica oleracea* var. *capitata*), broccoli (*B. oleracea* var. *italica*), knol-khol, Brussels sprouts, kale and other related Brassica vegetables. They are widely cultivated because of their high nutritional value, containing vitamins, minerals, dietary fibre and various health-promoting phytochemicals such as glucosinolates. However, cole crops are susceptible to several fungal, oomycete, bacterial and viral diseases, particularly under cool and humid conditions. Therefore, integrated disease management (IDM) is essential for sustainable production of cole crops. **Important diseases of cole crops are describes below:**

Club root:

Causal organism: *Plasmodiophora brassicae*.

It is a soil-borne, obligate parasite (it requires living host tissue to multiply).

Symptoms:

- Plants become stunted and weak, Leaves may become yellowish or pale green.
- During hot weather, plants show wilting, especially during the daytime.
- The characteristic symptom is the formation of large, irregular, swollen growths or galls on the roots & the swollen roots interfere with the absorption and transport of water and nutrients.



Favourable conditions:

- Acidic soil, poorly drained or waterlogged soil.
- Monocropping, High soil moisture, Warm soil temperatures.
- The pathogen can spread through: Infected seedlings, contaminated soil & water

Pythium Damping-Off

Causal organism: *Pythium*, which is oomycetes, pathogen survives in soil & infected plant debris.

It produces sporangia, which can produce motile zoospores under suitable conditions.

It also produces resistant oospores, allowing the pathogen to survive unfavorable conditions.

The pathogen is favored by excess soil moisture and poor drainage.

Symptoms:

- Pre-emergence damping-off**
- The pathogen attacks the seed or germinating embryo before the seedling emerges from the soil.

- **Post-emergence damping-off:** The seedling emerges normally but is attacked shortly afterward.
- A water-soaked, soft lesion develops near the soil, stem becomes thin and weak at the point of infection. Young seedlings die rapidly.
- The typical appearance is a healthy-looking seedling that suddenly falls over at the soil surface.



Favourable conditions: Over-irrigation, Crowded seedlings and poor ventilation

Downy Mildew

Causal organism: *Hyloperonospora brassicae* (earlier as *Peronospora parasitica*). It belongs to the oomycetes (obligate parasite).

Symptoms:

- This pathogen can attack both seedlings and mature vegetable plants.
- White, grayish-white or grayish-purple downy growth develops beneath the leaf spots. This growth consists mainly of sporangiophores and sporangia.
- The upper leaf surface of infected plants first turns yellow and then may turn brown or necrotic. Leaves wither and die.



Favourable conditions: Downy mildew is favored by cool temperatures and high humidity.

Alternaria Leaf Spot

Causal organism: caused by *Alternaria brassicae* and *Alternaria brassicicola*. These are true fungi that produce dark-colored spores called conidia (Muriform).

Symptoms:

- On seedlings, the symptoms are small dark spots on the stem that can cause damping-off or stunting of the plant.
- On older plants, the bottom leaves are infected first with brown circular spots on the leaves. Spots have characteristic concentric rings (target spots). Blackened areas may develop on cauliflower curds and on broccoli heads. Infected leaves soon turn yellow and drop.



Favourable conditions: Bright sunshine, frequent dews or showers and temperatures between 20 and 32 °C favor disease development.

Black Rot

Black rot is caused by a bacterium, *Xanthomonas campestris* pathovar *campestris*.

Symptoms:

- Initial symptoms appear as yellow, V-shaped lesions along the margins of leaves.
- The V-shaped lesion generally progresses towards the midrib.
- Veins within infected areas become dark brown to black, producing the characteristic black-rot appearance.
- Infected leaves gradually become yellow, brown and dry.
- Under severe infection, the disease may progress through the petiole and vascular system.



Favorable Conditions:

- Warm and humid weather, frequent rainfall or prolonged leaf wetness, wounds caused by insects or mechanical operations.

The bacterium can enter leaves naturally through hydathodes (water pores) at leaf margins or through wounds.

Black Leg

Causal organism: *Phoma lingam*

Symptoms:

- The symptoms of black leg are ash gray spots speckled with tiny black dots on the leaves and stem. Stems become girdled and the plants wilt and die.

Favorable conditions: Moist conditions favor development of this disease.



Fusarium Yellows

Causal organism: *Fusarium oxysporum* forma specialis *conglutinans*

Symptoms:

- Yellowing of leaves, defoliation of older plants, stunting and death of seedlings. Stems are often twisted to one side. On susceptible plants, symptoms may not appear until the soil warms up, close to the time of crop maturity.
- Yellows are more likely to cause a curve in the midrib.

Favorable conditions: Disease development is most severe between 80 to 85 °F.



Viruses

- There are several common viruses that can affect cole crops including *Turnip mosaic virus* (TuMV) and *Cauliflower mosaic virus* (CaMV). Infected plants may be stunted and have distorted leaves. Black spots that look like pepper develop on the heads of plants.



Turnip mosaic virus (TuMV)



Cauliflower mosaic virus (CaMV)

Symptoms: *Turnip mosaic virus*

- Light and dark green mosaic/mottling on leaves.
- Chlorotic patches and vein clearing.
- Leaves become puckered, distorted and sometimes necrotic.
- Severe infection causes stunting and poor head formation.
- Black necrotic spots may develop on cabbage heads.

Cauliflower mosaic virus

- Vein clearing and vein banding.
- Light and dark green mosaic patterns on leaves.
- Leaf distortion and curling.
- Plants may develop a bunched or compact appearance.
- Severe infection can cause stunting and reduced head development.

Integrated Disease Management (IDM)

Integrated Disease Management (IDM) refers to the integration of different compatible disease-management methods to reduce disease development and losses to an economically acceptable level.

Effective management of cole-crop diseases should focus primarily on prevention and early disease detection.

1. Use of Healthy Seed and Planting Material

- Use certified, disease-free seed and healthy seedlings.
- Avoid planting material collected from diseased fields.
- Use recommended seed-treatment methods.

2. Resistant Varieties

- Cultivation of disease-resistant or tolerant varieties is one of the most economical and environmentally friendly methods of disease management, particularly against club-root, black rot and other important diseases.

3. Crop Rotation

- Avoid continuous cultivation of cole-crops in the same field. Rotate with non-host crops such as cereals, where appropriate, to reduce the build-up of soil- and residue-borne pathogens.

4. Nursery management:

- Maintain a clean nursery and keep seedlings away from infected cole crops and cruciferous weeds. Early detection in the nursery is particularly important because infected transplants can introduce viruses into the main field.

5. Soil management

- Maintain soil pH around 7.0 or slightly above, where suitable (application of Lime in acidic soils for managing club root disease).

Field Sanitation

- Remove and destroy infected plant residues.
- Control weeds that may harbour pathogens. These weeds can serve as reservoirs for viruses and/or their aphid vectors.
- Clean nursery beds and cultivation tools.
- Avoid planting in fields with a history of severe disease whenever possible.

6. Proper Water and Nutrient Management

- Avoid waterlogging and provide adequate drainage.
- Avoid unnecessary overhead irrigation, particularly where bacterial and foliar diseases are prevalent.
- Maintain balanced nutrition and avoid excessive nitrogen application.

7. Avoid mechanical injury- because wounds can provide entry points for the bacterium.

8. Monitor the crop regularly

- Frequent scouting for mosaic, mottling, leaf distortion, stunting and other virus symptoms, along with monitoring of aphid populations, helps in early detection and management.

9. Biological Management

- Beneficial microorganisms such as *Trichoderma* spp. and *Pseudomonas fluorescens* can be incorporated into an IDM programme, particularly for management of soil-borne pathogens.

10. Chemical Management

- Fungicides and bactericides should be used only when required and according to locally approved label recommendations. Selection of the appropriate active ingredient should depend on the disease, crop and stage of infection. Rotation of fungicide groups can help reduce the risk of fungicide resistance.

11. Control of vectors

- TuMV and CaMV are transmitted by aphids. Monitor aphid populations regularly and use appropriate integrated aphid management. However, insecticides alone may not

completely prevent virus transmission because aphids can transmit some viruses very rapidly before they are killed.

Conclusion

Cole crops are affected by several diseases that can seriously reduce plant growth, yield and market quality. No single management method is sufficient for effective disease control. An integrated approach involving disease-free seed, resistant varieties, crop rotation, sanitation, proper irrigation, biological control, regular monitoring and judicious use of approved pesticides provides a sustainable strategy for managing major diseases of cole crops and maintaining profitable production.

References

1. Agrios, G.N. (2005). Plant Pathology. 5th ed. Elsevier Academic Press, Burlington, Massachusetts, USA.
2. APS (American Phytopathological Society). Compendium of Brassica Diseases. 2nd ed. APS Press, St. Paul, Minnesota, USA.
3. CABI. Crop Protection Compendium. CAB International, Wallingford, UK.
4. Cornell University. Disease Factsheets: Crucifers (Brassicas and Cole Crops). Cornell Vegetable Program, College of Agriculture and Life Sciences.
5. Davis, R.M., Nunez, J.J. and Subbarao, K.V. Diseases of Cole Crops. University of California Agriculture and Natural Resources, Integrated Pest Management Program (UC IPM).
6. Khurana, S.M.P. and Bhardwaj, U. (2013). Diseases of Vegetable Crops. Kalyani Publishers, New Delhi, India.
7. Sherf, A.F. and MacNab, A.A. (1986). Vegetable Diseases and Their Control. 2nd ed. John Wiley & Sons, New York, USA.
8. Singh, R.S. (2017). Plant Diseases. 10th ed. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, India.
9. Rangaswami, G. and Mahadevan, A. (2005). Diseases of Crop Plants in India. 4th ed. Prentice-Hall of India, New Delhi.
9. University of California Agriculture and Natural Resources (UC ANR). Cole Crops: Agriculture Pest Management Guidelines. UC Statewide Integrated Pest Management Program.