

Major Diseases of Mustard Crops and Integrated Disease Management Practices for Sustainable Cultivation

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Abstract:

The genus Brassica represents a highly diverse group of oilseed crops extensively cultivated in India. This group encompasses the Indian mustard, yellow sarson, brown sarson, Raya, and toria. These crops are primarily self-pollinated, although some degree of cross-pollination also occurs. Mustard (*Brassica* spp.) is an important oilseed crop facing significant yield losses due to various diseases. Among several diseases, four diseases viz; Alternaria blight (*Alternaria brassicae*), white rust + downy mildew complex (*Albugo candida* + *Hyaloperonospora parasitica*), Sclerotinia stem rot (*Sclerotinia sclerotiorum*), powdery mildew (*Erysiphe cruciferarum*) and black rot (*Xanthomonas campestris* pv. *campestris*) are of great economic importance. These diseases cause substantial damage through leaf blight, stunting, and reduced seed yield. Integrated disease management (IDM) strategies offer sustainable solutions. Key components of IDM include the use of disease-resistant varieties, crop rotation, sanitation, cultural practices, biological control, and judicious use of fungicides. By implementing these strategies, growers can effectively manage diseases and enhance mustard productivity.

Introduction:

Brassica juncea, a prominent oilseed crop in India, is mainly cultivated in cooler regions of the country, particularly in eastern, northern, and northwestern states. These regions offer favourable winter conditions for optimal growth and yield (Banerjee *et al.*, 2010). In contrast, warmer climates of central

and southern India limit mustard cultivation primarily to intercropping systems, with seed production primarily for condiment purposes. In India, Indian mustard [*Brassica juncea* (L.) Czernj.] is grown in an area of 8.74 million ha, with the production of 10.95 million tonnes and average productivity of 1,270kg/ha (MoA

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& FW, GoI, 2022). Significant regional variations in mustard yield are observed across India. The national average yield, typically ranging between 900-1150 kg ha⁻¹, often falls short of the attainable potential of 2500-3000 kg ha⁻¹. This shortfall is primarily attributed to the detrimental impact of inadequately managed or unmanaged diseases and pests throughout the crop's growth cycle. Some of the major diseases are-

crops, leading to significant yield losses (Devi et al., 2024). It is a necrotrophic pathogen that causes lesions in leaves, stems, and siliquae that significantly affect the quality and quantity of mustard (Mishra et al., 2024). Symptoms are characterized by water soaked, small, circular, brown lesions on the lower surface of the leaves. These spots become enlarge and develops into prominent round spots with concentric rings.

S. No.	Name of the disease	Causal organism
1.	Alternaria blight	<i>Alternaria brassicae</i>
2.	White rust	<i>Albugo candida</i>
3.	Downy mildew	<i>Hyaloperonospora parasitica</i>
4.	Sclerotinia stem rot	<i>Sclerotinia sclerotiorum</i>
5.	Powdery mildew	<i>Erysiphe cruciferarum</i>
6.	Black rot	<i>Xanthomonas campestris</i> pv. <i>campestris</i>

Alternaria blight: *Alternaria brassicae*

White Rust: *Albugo candida*



Alternaria blight, caused by *Alternaria brassicae*, is a major disease affecting mustard

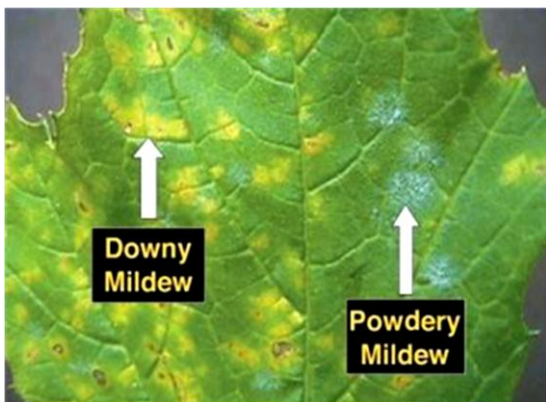


The fungus infects leaves and floral structures, resulting in the formation of

characteristic white, elevated pustules beneath the plant's outer layer (epidermis). These blister-like structures can sometimes cause abnormal growth and deformation of stems, leaves, or flowers. Upon maturation, the pustule's covering ruptures, releasing powdery white sporangia (a type of spore) that can be readily dispersed by wind or water, thereby infecting nearby host plants.

Downy mildew: *Hyaloperonospora parasitica*

The disease is characterized by the appearance of irregular greyish-white necrotic lesions on the lower leaf surface. These lesions are typically accompanied by the formation of corresponding yellow spots on the upper leaf surface, creating a visually distinct pattern. Later under favourable conditions brownish white fungal growth may also be seen on the spots. The most pronounced symptom is the infection of inflorescence causing hypertrophy of peduncle (Stag head formation caused by white rust and downy mildew complex).



Sclerotinia stem rot: *Sclerotinia sclerotiorum*

Stems develop water-soaked lesions near the crown region, which may subsequently become covered with a dense, cottony white mycelial growth. As the disease progresses, affected stem portions display a bleached appearance at the internodes, ultimately leading to tissue disintegration. Symptoms include premature ripening and shredding of stems, plant wilting, and desiccation. In advanced stages of infection, black sclerotial bodies may be observed on infected plants.



Powdery mildew: *Erysiphe cruciferarum*

Small, circular, white patches appear on the leaves, first on the bottom surface. The patches may grow and cover the entire leaf. The edges of the leaves curl upwards, exposing the white patches. Purple or reddish blotches may appear on the leaves. Tiny, round, black fungal structures called

cleistothecia may appear on the underside of the leaves. The leaves may turn yellow, then brown, and fall off prematurely.



Black rot: *Xanthomonas campestris* pv. *campestris*



The leaf tissue turns yellow and chlorosis reach towards the centre of the leaf and form V shaped area with base of V towards the midrib. The veins show brown to black discoloration. Dark coloured streaks are formed on the stem from the ground level and gradually these streaks enlarge and girdle the

stem. Stem become hollow due to internal rotting. Midrib cracking of lower leaves, browning of veins and withering is observed. In severe cases, the vesicular bundles of the stem also turn brown and the plant collapses.

Integrated Disease Management

- ⇒ Grow disease-resistant or tolerant varieties.
- ⇒ Use healthy, certified quality seeds.
- ⇒ Treat seeds with Ridomil or Apron 35SD at 4g/kg when infection occurs.
- ⇒ Sow Toria in the second fortnight of September and Mustard in the first week of October with a balanced fertilizer dose (N 100 P 40 K 40 kg/ha) and mineral nutrients (Sulfur 40, Zinc Oxide 15, Borax 10 kg/ha).
- ⇒ Avoid excessive use of nitrogenous fertilizers.
- ⇒ Destroy crop residues to prevent pathogen survival, e.g., *Sclerotinia sclerotiorum*.
- ⇒ Implement crop rotation with non-host crops for 2-3 years.
- ⇒ Spray Ridomil MZ (0.2%) at 45-50 DAS, Mancozeb (0.2%) at 60-65 DAS, and if necessary, Ridomil MZ (0.2%) again at 75-80 DAS for managing downy mildew, white rust, and Alternaria blight (Biswas *et al.*, 2007; Kolte, 1985). In case of severe powdery mildew in central Indian

states, Karathane or carbendazim at 0.05-0.1% is effective.

- ⇒ Control seedling blight and damping-off diseases caused by *Rhizoctonia solani*, *Sclerotium rolfsii*, and/or *Fusarium* species with seed treatment using a mixture of thiram + carbendazim (2:1) or thiram + carboxin (2:1) at 0.2%. For downy mildew at the seedling stage, treat seeds with Apron 35 SD (metalaxyl) at 6g/kg (Kolte, 2009).
- ⇒ To manage Sclerotinia rot, apply *Trichoderma*-colonized cow dung or vermicompost into the soil, followed by seed treatment with garlic bulb extract (2%) and *Trichoderma* (10g/kg seed).
- ⇒ Antagonists like *Trichoderma harzianum*, *T. viride* (G R isolate), *Streptomyces rochei*, and *Bacillus subtilis* (UK-9) are effective against *Alternaria brassicae*, *A. brassicicola*, and *Plasmodiophora brassicae* (Kolte, 2009).
- ⇒ For club root management, amend the soil with lime (1 kg/m²) to raise pH to 7.2 or apply Neem cake (0.5 kg/m²).
- ⇒ To manage powdery mildew, apply three sprays of aqueous suspensions of Triadimefon 25 WP (0.1%) and Wettable Sulphur 80 WP (0.3%) at 15-

day intervals after disease appearance. This effectively controls the disease and increases seed yields (Singh and Singh, 2003).

- ⇒ Garlic bulb extract (1% w/v) and leaf extracts of *Azadirachta indica* (neem) (1.5–2%) and Eucalyptus species are promising options for disease management (Meena *et al.*, 2004).
- ⇒ For Sclerotinia rot management, apply *Trichoderma*-colonized cow dung or vermicompost, followed by seed treatment with garlic bulb extract (2%) and *Trichoderma* (10g/kg seed). Spray Carbendazim (0.1%) at 50-55 DAS, 65-70 DAS, and if necessary, at 80-85 DAS
- ⇒ Streptocycline is most effective antibiotics to control black rot disease (Kavathiya *et al.*, 2017).

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