

Alternaria blight disease – A serious problem in the seed production of radish (*Raphanus sativus*)

Seed is the ultimate input used for the cultivation of any crop. The production of healthy quality seeds free from pests and diseases is the ultimate goal and a big challenge in the seed production centres. Radish is an edible root vegetable grown mainly in the tropical and subtropical regions of the world. The crop in the field is infected by number of plant pathogens including fungi, bacteria and viruses causing significant economic losses. Among them, *Alternaria* blight is one of the serious disease affecting yield and quality of seeds. It is observed during all the stages of the crop covering entire plant parts and causing nearly half of seed yield loss varying from year to year. The successful management of the disease depends on the correct identification of the causal organism responsible for causing the disease. Considering this, the article briefs about the identification of the disease based on the symptoms, causal organism, cultural and morphological characteristics of the pathogen, disease cycle, conditions required for the spread of the pathogen and best management practices that can be practiced for the successful control of *Alternaria* disease of radish in the field.

RADISH (*Raphanus sativus* L.), globally consumed as root vegetable, belongs to *Brassicaceae* family. It is cultivated in both tropical and temperate regions around the world, because of its ease of cultivation and wider adaptability. The entire plant is edible, including the taproot, leafy tops, flowers, pods, and seeds, but taproot is commonly used for consumption. It is low in calorie and rich in folic acid, fibre, potassium, etc. It is beneficial to persons suffering from liver ailments, piles, urinary disorders, cancer, leucoderma, skin disorders, and kidney. In India, radish is cultivated majorly in the parts of Haryana, West Bengal, Punjab, Assam, Chhattisgarh, Bihar and Uttar Pradesh million., in a total area of 2.02 lakh hectares with an annual production of 3.167, million MT (1st Advance Estimate, Department of Agriculture and Farmers' Welfare, 2024-25). The yield of radish crop mainly depends on the seed material used for the cultivation. So, there is a need for production of healthy seeds with good quality to increase the yield of radish. The crop is susceptible to several diseases, including damping off, *Alternaria* blight, leaf spot, white rust, *Fusarium* rot and black rot. Among these, *Alternaria* blight is the main threat to seed production of radish where it is reported to be caused by various species such as *Alternaria raphani*, *A. alternata*, *A. brassicae* and *A. brassicicola*, poses the most significant threat, resulting in substantial yield losses in radish.

Alternaria blight of radish

Alternaria blight, predominantly caused by *Alternaria*

raphani, is the most prevalent and devastating disease affecting radish cultivation worldwide. The disease has been reported from various countries including India, Canada, Denmark, USA, Egypt, Greece, Bangladesh, Japan and Netherlands. Another species *i.e.*, *Alternaria alternata* is also identified as a causal organism in certain regions of India. The disease can be seen during all the stages of the crop including seedling stages. The pathogen infects both seed and root crop production, resulting in the loss of 35-38% yield in crucifers. Researchers had reported a huge seed yield loss (up to 46.48%) which varies from year to year depending on the environmental conditions in radish.

The symptoms of the *Alternaria* blight are visible in both fresh vegetable and seed production. The pathogen attacks all the portion of the radish plant including leaves, stem, pods and seeds. Initially the disease appears on the older leaves as a small necrotic spots surrounded by



Symptoms of *Alternaria* blight observed during seed production of radish at IIVR, Regional Research Station, Sargatia, Kushinagar

a yellow halo before flowering stage, which gradually increase in size. Subsequently, typical dark brown spots extend to the entire stems and seed pods. The spots will develop into concentric circles on the pods and tender twigs during later stages. As the disease spreads through entire plants, the entire pods become infected with spots with the style end turning black and shrivelled resulting in premature collapse of the pod stacks before the seed set which finally leads to huge loss. The fungus penetrates in pod tissues, ultimately infecting the seeds, and infected seeds fail to germinate or show poor germination.

Cultural and morphological characteristics of the pathogen

The pathogen grows well on Potato Dextrose Agar (PDA) media and appears as woolly or fluffy masses after 3-4 days of inoculation, which later become denser and cottony as the colony matures. The hyphae of *Alternaria* looks initially hyaline, shows septation and branching, after few days the hyaline hyphae turns to brown or olivaceous brown. The conidiophores produced are simple and erect, emerge singly or in clusters. The muriform conidia are formed singly or may occasionally form in chains; they are brown to dark brown in colour and possess a shorter beak. The resting chlamydospores produced are usually round, olive-brown and have multiple cells.

Mode of spread of the pathogen

The primary infection occurs from mycelium or conidia present in the infected seed or plant refuse upon contact with the leaves. The secondary infection takes place through the transport of air borne conidia and chlamydospores by wind, insects, water splash and human activities leading to severe spread and infection. At the end of the season the pathogen persists in the infected plant debris, seeds, susceptible weeds or perennial crops which became a source of infection for the subsequent or next season.

Management of the disease

The successful disease management needs a comprehensive approach which incorporates cultural, biological and chemical control measures. Following are the best possible practices that can be employed for the effective management of *Alternaria* blight disease of Radish.

- Removal and destruction of diseased crop debris to minimize pathogenic inoculum.
- Since the pathogen can survive in the cruciferous weeds, timely weeding is required in the field to check the growth and spread of the pathogen.
- Avoid overhead irrigation, use drip irrigation or water early in the day to allow foliage to dry quickly.
- Crop rotation should be followed with non-cruciferous crop to break the disease cycle and reduce inoculum build-up in the soil during severe conditions.
- Use of resistant or tolerant varieties can significantly reduce disease severity.
- Seed treatment with bio-control agents *Trichoderma*



Cultural and morphological characteristics of *Alternaria* spp. (A) Top view of *Alternaria* colony on Potato Dextrose Agar (PDA); (B) Reverse view of colony on PDA; (C) Branching of hyphae and septate mycelium; (D and E) Muriform conidia

viride @ 2 g / 100 g seeds or *Pseudomonas fluorescens* and *Verticillium chlamydosporium* @ 10 g/kg seed. The chemicals such as Thiram 75 WP @ 3.0 g per kg seed or Captan 75% WS @ 1.5 to 2.5 g/litre is effective in controlling the disease.

- The bio-control agents fungicides should be applied based on disease incidence, using active ingredients such as Mancozeb at 2.0 g per litre of water, or strobilurin fungicides like Azoxystrobin or triazole fungicides such as Tebuconazole at 0.5–1.0 mL per litre of water. The first application should be made at the onset of initial disease symptoms, with a second application 15-20 days later.
- In cases of higher disease pressure, additional applications may be necessary, alternating between fungicides from different chemical groups to effectively manage the disease, particularly for seed production.

SUMMARY

Alternaria blight is one of the threatening disease especially in the seeds production of radish. The management of the disease is difficult once it is established. The disease spreads very rapidly and cover entire field within few days and may cause severe loss in yield. The accurate identification of the pathogen, understanding the nature and spread of the pathogen is more important to take up the best possible management practices by integrating all the components such as cultural, biological and chemical practices for the effective control of *Alternaria* blight of Radish.

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