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Alternaria Blight Diseases of Cumin and Their Management

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Cumin (*Cuminum cyminum* L.) a dried seed from the Umbelliferae family, is one of the key spices. Believed to be native to the Mediterranean region. Cumin is extensively cultivated in countries like Tajikistan, Turkey, Uzbekistan, Morocco, India, Egypt, Mexico, Syria, Pakistan and Chile. It goes by various names across the globe, including “Jeera” in Hindi, “Kumin” in German, “Komijn” in Belgium and “Faux Anis” in French. It is an essential spice extensively used in Indian cuisine for its distinctive flavor and aroma. It contains several phytochemicals with beneficial properties, including anti-flatulent, carminative and antioxidant effects, largely attributed to its aldehydes, volatile oil and cuminol content. Cumin seeds are rich in minerals, essential antioxidant vitamins, flavonoids, carbohydrates, proteins and fats. It is cultivated mainly in the Indian states of Rajasthan and Gujarat, which offer favorable semi-arid climates and soil conditions. This spice is vital for the livelihoods of farming communities across its cultivation areas. However, diseases like wilt, Alternaria blight and powdery mildew, coupled with nutrient deficiencies, cause significant productivity losses. Among the challenges, Alternaria blight has emerged as a particularly devastating threat, causing significant yield losses up to 85%. Additionally, issues such as high chemical residues in cumin seeds, the rise of pathogen resistance and the continuous cultivation of disease-susceptible varieties have exacerbated difficulties for farmers. These factors sometimes lead to complete rejection of the exported consignment.

Extent of damage

The blight disease of cumin is caused by *Alternaria burnsii* and in India first report of cumin blight from Gujarat by Uppal *et al.* (1938) and subsequently reported in Rajasthan by Joshi (1955) and Patel (1968). This pathogen was later identified by Shakir *et al.* in 1995. *Alternaria burnsii* has since been found to be widespread in arid and semi-arid regions about the worldwide, with severe incidences reported in countries such as India, Iran, Tajikistan, Uzbekistan, Egypt, Syria, Turkey, Morocco, Chile, Mexico, Bulgaria and Cyprus. This disease can cause crop losses of up to 80%, manifesting annually in the most productive cumin-growing areas.

Symptoms

The disease symptoms appears at flowering at about 30-35 days old plants in the form of small necrotic spots on the aerial parts, viz., leaves, inflorescence, seeds etc. which enlarge, coalesce and turn purple brown to black and under favourable environmental conditions stem and flowers are also infected. Blight appears in the form of dark brown spots on leaves as well as stems, whereby the stem tips bend downwards. The diseased crops show the burn appearance from the distance. In such infected plants seed formation is adversely affected, when the developing seeds remain small, shrivelled, lightweight and blackish in colour. The Conidia of blight can survive under warm and dry conditions for several months. Disease majorly appears during warm humid weather at flowering stage and thus seed cannot mature to full size.



Cumin blight disease symptoms

Disease Cycle

The pathogen is seed borne and also survives on the crop debris in soil. The studies revealed that survival of the pathogen on seed during storage was 100 per cent during the month of April and May, which reduced to 70 per cent during October, November under laboratory condition at 25°C temperature and 40-50 per cent relative humidity. Whereas, in infected crop debris on soil, its survival was 40-60 per cent during October- November. Infected seeds are the primary source of inoculum to an extent of 10-32 per cent. The fungus may remain viable for 10 months in seed and the crop debris. Secondary source of inoculum are conidia, which spread through wind. The environmental conditions viz., relative humidity of about 90 per cent and temperatures of 23-28°C favour the pathogen as well as the development of the disease.

Favorable Conditions

Alternaria blight levels in wet weather where temperatures range from 20-32°C, accompanied by generous humidity levels and a cloudy ambiance. It is during these meteorological circumstances that the disease assumes its full, formidable form, leaving cumin crops vulnerable to its ravages.

Epidemiology

Conidial germination of the pathogen was found maximum at 26-27°C. The pathogen survives mainly in seeds and the infected seeds play an important role in the transmission of the pathogen. Rain, persistent cloudy weather, cool humid conditions with >85 per cent humidity and 23-28°C temperature favour disease development. The early sown crop particularly during October has greater severity of the disease. December sown crops found to have less disease incidence, but has also less seed yield. Maximum temperature between 29° -35.5°C, minimum temperature 9.6° to 19.7°C, average relative humidity of >60 per cent in the morning and >28 per cent in afternoon, wind speed 2.1-4.8 km/hr and 8-10.4 bright sunshine hours were favourable for disease development.

Management

(1) Management through Cultural Practices

- ❖ Timely sowing of the crop during November. Give light irrigation to crop during daytime and avoid water logging in field.

- ❖ Collect and destroy the infected plant debris. Follow crop rotation and select disease free field for cumin cultivation.
 - ❖ Treat the seed with thiram @ 3-4 g/kg of seed.
 - ❖ Use of balance chemical fertilizers i.e. apply 30 kg N + 30 kg P₂O₅ /ha as basal and 30 kg N/ha as top dressing at 30 DAS for obtaining higher yield.
- (2) Use of botanicals and bioagents for the disease management:-**
- ❖ Seed treatment with thiram or carbendazim @ 3-5 g/kg seed to control seed borne pathogen and treatment of 100 g Trichoderma formulations with one kg seed gave good control of the disease. However, prophylactic spray of 0.2 per cent mancozeb or zineb are suggested during cloudy weather or at the initiation of the disease.
 - ❖ Soil application of *Trichoderma viride* @ 2.5 kg/ha in 100 kg FYM + seed treatment with Carbendazim @ 1 g/kg seed followed by two sprays of difenconazole @ 0.05 per cent at 35 and 50 days after sowing was found better to manage wilt and blight of cumin.
 - ❖ Use of bioagents and the fungicides have been found to reduce the fungicides load/reduce pesticide residue in the crop. *Trichoderma harzianum* when applied in the soil grown on sorghum seeds (24 g/6 m²) resulted least blight disease. Similarly, when 10 per cent spore suspension of *Trichoderma harzianum* was used as seed treatment and as spray at flowering of the crop resulted in best control of the disease.
 - ❖ Extract of garlic cloves and ginger rhizomes (5 per cent and 10 per cent) were found effective in inhibiting the growth of *Alternaria burnsii* while, *Trichoderma harzianum* and *Trichoderma viride* Anand isolate were most effective resulting in 100 per cent inhibition of *Alternaria burnsii* under *in vitro* condition at Junagadh.
- (3) Chemical Fungicides**
- ❖ Seed treatment with difolatan, captan was found beneficial. Cuman mancozeb, copper oxychloride, zineb are recommended as spray.
 - ❖ The most effective field management of the disease was achieved with Mancozeb (0.20%), followed by Copper oxychloride (0.25%) and Thiophanate Methyl (0.02%).
 - ❖ Regular spraying of Mancozeb (0.25%) or Cymoxanil (0.1%) at ten day intervals after blooming was found to be effective for blight management in field conditions.
 - ❖ In laboratory studies that Hexaconazole, Tebuconazole, and Mancozeb were the most effective fungicides.

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