



Anthracnose-Twister Complex: An Emerging Disease of Onion in India

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Abstract

Onion (*Allium cepa* L.) is most profitable spice-vegetable crop in India, but it is susceptible various fungal, bacterial, viral and nematode diseases which affects bulb production. Among several fungal diseases anthracnose and anthracnose-twister complex are the major destructive diseases incited by *Colletotrichum gleosporioides* and *Fusarium moniliformis* in all cropping seasons particularly kharif onion leads 80% yield losses in field which causes shortage of onion in the market as a result there will be increase in the onion price. So ultimately farmers rely on chemicals to manage the disease which raise the production costs and cause problems for the environment and human health. This article's emphasis on symptomatic diagnosis, favourable factors that led to the epidemic of the disease and integrated management strategies to tackle the threat will be extremely helpful to onion growers, students, extension workers and other onion researchers.

Keywords: Anthracnose-twister, Favourable conditions, Integrated disease management, Onion

Introduction

Globally onion used as vegetable, salad ingredient and also as spice. Around the world, it is cultivated in variety of climatic conditions from semi-arid to temperate. India held the top position globally in onion cultivation covering 13.7 million ha and 24.25 million t production during five year period from 2017-2021. However, India's onion productivity measured at 16.40 tons hectare⁻¹ and ranked 90th position, being far lower than many other countries (Dutta *et al.*, 2024). In India, Maharashtra is the major onion producing state followed by Madhya Pradesh, Gujarat, Karnataka and Rajasthan (Dutta *et al.*, 2024). However, certain constraints like lack of standardized/ recommended varieties for specific agro-ecological situations, unavailability of planting materials, water stress, high incidence of diseases, problems in curing and drying of onions after harvest, sprouting *etc.* hamper the onion availability. Anthracnose-twister complex, *Stemphylium* blight, purple blotch are destructive fungal disease affects the quality and quantity of the bulbs. In tropics and subtropical countries in the world, anthracnose or severe curl disease is most dangerous especially in *kharif* onion and during 1969 this disease was first reported in

North Nigeria, causes bulb losses to the tune of 50-100% (Ebenebe, 1980). These pathogen causes leaf infection results in the yield reduction up to 100% and after storage for the bulb disease phase. Though the disease causing showing 100% yield losses specify still the effective management practices are lacking. For effective management approaches, it is necessary to understand pathogenesis and disease cycle host pathogen interaction and susceptible stage of the crop.

Symptoms and Causal Organism

The pathogen, *Colletotrichum gleosporioides* infection produces symptoms on all the parts of onion *viz.*, leaf sheath, leaves, neck, pseudo stem, neck and bulbs (Chowdappa *et al.*, 2015). Infected plants exhibit chlorosis, abnormal neck elongation, curling and twisting of leaves and bulb rotting (Figure 1). On leaves anthracnose symptoms are more prominent initially the pathogen producing water-soaked lesion becomes white or yellow colour sunken spots on leaves at early vegetative stage. The spots coalesce and covers entire leaf and the spots produces salmon colour fruiting bodies in concentric rings as disease progress the fruiting bodies turns to black colour, which containing sexual

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fruiting bodies (Dutta et al., 2022). These lesions eventually become brittle and paper-like, which makes it easy for them to fall off at the lesion site. Under extreme circumstances, the lesion appears on the bulb scales, the bulbs rot and the

entire plant dies (Figure 2). The affected roots remain very thin and shorter and slender bulbs under field conditions. In severely infected plants produces slender bulbs and/or no bulb formation and wilting of the plants (Dutta et al., 2024).



Figure 1: Anthracnose-twister disease complex



Figure 2: Anthracnose disease

Anthracnose disease caused by facultative parasite *Colletotrichum gleosporioides* (PS: *Glomerella cingulata*) is having wide host range. The genus *Colletotrichum* having wide host range infects fruits, vegetables, cereals crops, grasses and ornamental plants (Chowdappa et al., 2015). Dutta et al. (2022) showed anthracnose-twister is a complex disease incited by the species of *Colletotrichum* and *Fusarium*.

Disease Cycle

The overhead method of irrigation increasing humidity of 85-96%, 20-30 °C temperature and cloudy weather, rainfall could aggravate the pathogen and spreads the inoculum in the crop stand which serves as acervulli hence this disease considered as seed borne disease and infection transmits on seedlings and bulbs. The spores of pathogen also survives on collateral hosts because the pathogen having wide host range. Depends on the favourable or congeinal condition during crop growth viz., temperature, humidity, rainfall disease intensity will increase. The secondary infection mainly occurs through air borne conidia of the pathogen which are spread through rain splash, irrigation water and insects.

Integrated Disease Management

The disease is complex, which is responsible for significant yield losses in the onion production, especially during kharif. However, the effective management strategies are insufficient and it is essential to understand the pathogens nature, infection cycle, disease cycle host pathogen interaction, favourable conditions and vulnerable stages of the crop to develop the effective sound management practices to reduce the disease. Therefore, by integrating different techniques like cultural, physical, biological and chemical can develop integrated modules for effective management.

Cultural Management

By reducing the disease raised bed nursery is recommended.

And also filed sanitation, soil solarisation, using disease free seeds for sowing appropriate time of planting, with wider spacing, avoiding overhead irrigation, using recommended dose of fertilizers, avoiding monocropping and rotating the crop with cereal or pulses crops for two to three years can reduces the primary inoculum in the field (Alberto and Perez, 2020).

Biological Management

Using plant extracts, biocontrol agents to manage the fungal diseases in onion is effective eco-friendly approach done by several researchers for this pathogen. Several researchers evaluated different biocontrol agents, viz., *Trichoderma*, *Gliocladium*, *Bacillus* and *Streptomyces* to manage *C. gleosporioides* under *in vitro*. Under field conditions powder formulation of *Trichoderma harzianum*, *T. hamatum*, *Penicillium chrysogenum* and *Chaetomium cupreum* used to manage the anthracnose disease.

Chemical Management

Since from many years, some of the common fungicides, viz., Carbendazim, Mancozeb, Propiconazole, Hexaconazole, Thiabendazole etc. are recommending to reduce the spread of anthracnose disease. Using 0.2 g L⁻¹ Benomyl for soil application reduces the disease. Carbendazim and Captafol 10 or 15 g per 20 litres were the most effective for the management of anthracnose of onion. Trifloxystrobin + Tebuconazole 75 WG, Pyraclostrobin + Metiram 60 WG and Fluzinam 500 SC found effective for managing the anthracnose disease.

Overall Integrated Management Practices

- Elimination and destruction of affected crop debris or field sanitation reduces the primary infection. Crop rotation with non-host crops for 3-4 years can reduces the pathogen population, improves the soil health and reduces the outbreak of the disease and planting of onion in the raised bed avoiding use of excessive nitrogenous fertilizers and water logging reduces the disease. Before sowing seeds are

treated with 1.5 g kg⁻¹ of Thiophenate methyl or 3 g kg⁻¹ of Captan and before planting seedlings dip with *Trichoderma harzianum* (10 g L⁻¹) for 2 hrs reduce the disease.

- On the onset of disease initiation spraying of Metiram + Pyraclostrobin at 2.5% or Mancozeb 0.25% or Hexaconazole at 0.1% can reduce the disease at 10-15 days interval.
- Field application of *T. harzianum* (5 kg ha⁻¹) with FYM (250 kg ha⁻¹) at 35, 65 and 90 days after transplanting manage the disease both in pre-harvest and post-harvest condition.

Conclusion

Heavy rains during the *kharif* crop growth period increase anthracnose-twister disease, resulting in lower production of *kharif* onions. The arrival of a reduced quantity of onions in October and November creates a supply-demand gap, thereby causing an increase in onion prices. As of now, farmers are mainly relying on chemicals which increase the cost of production and create health and environmental issues. Therefore, the integrated disease management approaches is useful for to minimize the yield losses from anthracnose-twister disease.

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