

Spot Blotch Disease of Wheat and Barley: Symptoms and Disease Management

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Wheat (*Triticum* spp.) and barley (*Hordeum* spp.) are two of the most important cereal crops cultivated and consumed globally. In the case of wheat, India crossed the milestone of 100 million tonnes of production in 2019. Since then, with the adoption of improved varieties and technologies, wheat production and productivity have continued to increase every year. During 2024–25, India produced more than 117.50 million tonnes of wheat from over 33 million hectares of agricultural land. In the case of barley, despite its national and nutritional importance, the area and production have not increased as rapidly as expected. However, efforts are being made to increase barley cultivation and production in India. The production and productivity of wheat and barley are challenged by several biotic stresses, mainly diseases such as rusts, spot blotch or leaf blight, powdery mildew, bunt, and smut. Among these diseases, the

importance of spot blotch or leaf blight is often underestimated compared to the rust diseases. Over the last few decades, significant progress has been made in breeding rust-resistant varieties, and epidemics have



been successfully managed in many regions through the strategic deployment of resistant genes. Because of the major focus on rust research,

other diseases of wheat and barley remained relatively neglected, creating an opportunity for spot blotch disease to emerge as a major threat due to the lack of sufficient resistant germplasm against the pathogen. This article describes various aspects of spot blotch disease of wheat and barley, including symptoms, economic importance, pathogen characteristics, disease development, spread, and management strategies.

Economic Importance of Spot Blotch: In India, spot blotch disease was first reported in Bihar in 1914. The

disease commonly occurs in the warm and humid regions of Bihar, West Bengal, Uttar Pradesh, Odisha, Assam, Madhya Pradesh, Maharashtra, and Karnataka. Initially, it was considered a serious problem mainly in the north-eastern region of the country, but due to climate change and crop intensification, the disease has now spread extensively to north-western, peninsular, and central regions of India. Countries where wheat and barley crops are grown under warm temperature conditions during crop growth are highly vulnerable to spot blotch disease, which can cause severe yield losses. Under favorable conditions, the disease may cause more than 50% yield loss in wheat. In barley, susceptible varieties may suffer up to 80% yield loss under favorable disease conditions. During severe epidemics, the pathogen may even cause nearly 100% yield loss.

Symptoms of Spot Blotch Disease: The spot blotch pathogen is capable of infecting all plant parts including internodes, stem, nodes, leaves, awns, glumes, and seeds. The pathogen can cause pre-emergence and post-emergence damping-off, seedling blight, root rot, leaf spots, and spike blight at different growth stages of the plant. Initial lesions on leaves appear as small, dark brown spots measuring about 1–2 mm in length without chlorotic margins. In susceptible varieties, these lesions rapidly enlarge and develop into light to dark brown oval or elongated blotches, giving the appearance of leaf blight. Under favorable environmental conditions, spikelets may also become infected, resulting in shriveled grains and the development of “black point” symptoms on grains.



Fig 1: Symptoms of Spot blotch on wheat (A) and Barley (B); Colony of *Bipolaris sorokiniana* on PDA culture medium (C) and spore of *Bipolaris sorokiniana* under compound microscope

Causal Agent of Spot Blotch Disease: In 1959, Shoemaker proposed the generic name *Bipolaris* for those *Helminthosporium* species possessing fusoid, straight, or curved conidia that germinate through germ tubes from both ends. Spot blotch is caused by *Bipolaris sorokiniana* (synonyms: *Drechslera sorokiniana*; *Helminthosporium sativum*), a dematiaceous hyphomycetous fungus. The perfect stage of the pathogen has been identified as *Cochliobolus sativus*. The pathogen develops light to dark brown colonies on culture media. In older scientific literature, *Bipolaris sorokiniana* has also been referred to as *Helminthosporium sorokinianum*, *Drechslera sorokiniana*, and *Helminthosporium sativum*. Its conidia are thick-walled, slightly curved, and approximately $120 \times 12\text{--}20 \mu\text{m}$ in size, generally containing 3–9 septa. A conidiophore may produce either a single conidium (monosporic conidiophore) or multiple conidia (polysporic conidiophore).

Disease Development and Spread: Most *Helminthosporium* species are capable of causing disease under moderate to warm temperatures (18–32°C), especially in humid conditions. Spot blotch becomes most severe in environments characterized by high temperatures (above 17°C during cooler months) and high relative humidity. Infected seeds, crop residues, volunteer plants, secondary hosts, and dormant spores present in soil act as sources of inoculum for *Bipolaris sorokiniana*. This hemibiotrophic fungus sporulates on necrotic tissues during the crop season and eventually reaches the spikes and seeds, ensuring efficient pathogen survival. When infected seeds are sown, the coleoptile becomes easily infected, resulting in seedling infection that provides inoculum for the growing crop. Soon after sowing, fungal growth begins on moist seeds, and sporulation is induced under direct sunlight after seedling emergence at the first-leaf stage. Under favorable conditions, the pathogen rapidly infects leaves and spikes, causing severe yield losses. Conidia produced on the first infected leaves spread to healthy leaves through rain splash and wind, leading to polycyclic epidemics. Besides wheat and barley, several grass species also serve as hosts for *B. sorokiniana*, although their exact role in disease perpetuation in the Indian subcontinent is not fully understood.

Management Strategies for Spot Blotch Disease

Effective management of any crop disease, including spot blotch, can be achieved through the use of resistant varieties. This approach is cost-effective and environmentally safe. However, adopting this option

proves challenging due to a lack of sufficiently resistant varieties. Furthermore, alongside the use of resistant varieties, other strategies—such as cultural practices, fungicide application, and biological control methods—can help reduce the incidence of the disease. Details of these strategies are provided below.

1. Cultural Practices: The primary inoculum pressure of *B. sorokiniana* can be effectively reduced through crop rotations such as wheat/barley–sunflower and wheat/barley–soybean systems. Monoculture of wheat or barley should be discouraged. Burning crop residues may reduce inoculum by up to 90%, but due to its harmful environmental effects, it is not recommended. Early sowing, deep ploughing, balanced fertilizer application (especially nitrogen), destruction of crop residues, recommended seed rate, and proper plant spacing help reduce disease incidence. Cultivation of highly susceptible varieties in disease-prone areas should be avoided, and weeds and collateral host plants around the field should be controlled.

2. Use of Resistant Varieties: The most effective, economical, and environment friendly method for disease management is the cultivation of resistant varieties. Therefore, spot blotch-resistant varieties recommended for specific regions should be used.

3. Selection of Seed: Healthy and disease-free seeds are essential for obtaining a healthy crop. Seeds should be procured from reliable sources and produced in disease-free fields.

4. Seed Treatment: Seed treatment with fungicides helps protect germinating seeds and seedlings from

pathogens causing seedling blight. Effective control of spot blotch can be achieved by treating seeds with Carboxin 37.5% + Thiram 37.5% at the rate of 2.5 g per kg seed. Other effective fungicides include Captan, Mancozeb, Thiram, Tebuconazole, and Triadimefon.

- 5. Foliar Spray:** Fungicides such as Propiconazole, Mancozeb 75%, Zineb 75%, Tebuconazole 25.9%, Carbendazim 50%, Dithane Z-78, Iprodione, and Imazalil provide effective control of the foliar phase of the disease.
- 6. Biological Control:** Biological control agents such as *Trichoderma viride*, *Trichoderma harzianum*, *Chaetomium globosum*, and *Trichoderma virens* have been found effective against spot blotch caused by *Bipolaris sorokiniana*.

Conclusion

Spot blotch or leaf blight disease has emerged as a major constraint in the production of wheat and barley, particularly in warm and humid growing regions. Early disease diagnosis and proper pathogen identification are essential for successful disease management. Although several fungicides are available for disease control, concerns regarding their effects on human health remain important. Therefore, the exploration and use of effective biological control agents are becoming increasingly necessary. Sources of resistance against spot blotch are limited, and *Bipolaris sorokiniana* is emerging in areas where it was previously considered a minor disease. Hence, the development of resistant germplasm is critically important. Ultimately, adopting integrated disease management practices remains the best approach for effective disease control and achieving higher crop productivity.

