



## Wheat Leaf Rust: Incidence, Impact, and Management in Ropar District

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(Received: 22 August 2025; Revised: 28 September 2025; Accepted: 18 October 2025; Published online: 09 November 2025)

(Published by Research Trend)

DOI: <https://doi.org/10.65041/BF.2025.17.11.4>

**ABSTRACT:** The fungus *Puccinia triticina* is the cause of wheat leaf rust, a common and important disease for the wheat industry. Its persistence and spread in Punjab, especially in the Ropar district, are facilitated by traditional farming methods and favourable agro climatic conditions. The occurrence, severity, and control strategies of wheat leaf rust in Ropar during the Rabi season of 2023–2024 are assessed in this study. Lab diagnoses, farmer interviews, and field surveys were carried out. The results highlight the significance of integrated disease management strategies, which include timely fungicide applications, the use of resistant cultivars, and increased farmer awareness. The possible risks posed by changing pathogen races and climate change are also covered in this research.

**Keywords:** *Puccinia triticina*, wheat, leaf rust, Ropar, Punjab, India.

### INTRODUCTION

Over one-third of the world's population depends on wheat (*Triticum aestivum* L.) as a staple crop, and it is essential to India's food security. One of the top states for wheat production, Punjab, makes a substantial contribution to the central grain stockpiles.

Although wheat is threatened by a number of factors, rust is the greatest hazard to wheat. Globally, it results in enormously profitable losses. The cause of it is *Puccinia triticina*. The Middle East was where it started (Bolton *et al.*, 2008). It can tolerate a wide variety of environments because it is widely found in areas where wheat is cultivated. The fungi are obligatory spongers and biotrophs, meaning they need living things to finish their life cycle and complaint. The fungus is unique to its host. By wind, it can disperse urediniospores, basidiospores, and aeciospores to far-off places (Mendgen & Hahn 2002; Kolmer *et al.*, 2009).

As a result, it was more varied and caused wheat's financial losses; it promotes a wide range of environmental changes and increases the amount of inoculum to spread disease outbreaks (Abebe, 2021).

Higher humidity and temperate temperatures are ideal for its survival. The condition causes the grain in the kernel to lose weight and size. Leaf rust causes significant yield losses and varies over time and space (Huerta-Espino *et al.*, 2011).

Due to favorable humidity, warm winters, and a lack of widespread adoption of resistant cultivars, the disease has become more common in the Ropar district in recent years. This study examines the state of leaf rust

in Ropar and assesses how well different management approaches work there.

### MATERIALS AND METHODS

#### A. Study Area

Northeastern Punjab is home to the Ropar district, which has a subtropical climate. Fertile loamy soils and irrigation from both canals and tubewells are characteristics of the region. Wheat is harvested in March or April after being sowed from late October to early December.

#### B. Field Surveys

During the Rabi season of 2023–2024, surveys were carried out in ten villages and twenty randomly chosen wheat-growing areas. The Modified Cobb Scale was used to document the incidence and severity of the condition at each site (Peterson *et al.*, 1948).

#### C. Farmer Interviews

The following was evaluated using a standardized questionnaire: Knowledge of wheat rust illnesses Present-day management techniques Sources of assistance for seed and extension

#### D. Laboratory Analysis

To verify the existence of *Puccinia triticina* urediniospores, leaf samples exhibiting suspected rust symptoms were gathered and subjected to microscopical examination. In the laboratory, pathotype identification was carried out employing differential host lines.



Wheat Field



Wheat Leaf Rust Disease

## RESULTS AND DISCUSSION

### A. Disease Incidence and Severity

In 16 of the 20 fields that were surveyed, wheat leaf rust was found. The severity was highest in areas planted with older, vulnerable types like as PBW 343 and HD 2967, and the incidence ranged from 5% to 35%. Significantly lower infection levels (<5%) were seen in fields planted with more recent cultivars, such as PBW 826 and WH 1105.

### B. Symptoms and Pathogen Identification

Small, round to oval orange pustules (uredinia) that were mostly on the upper leaf surface with yellow halos surrounding them were the disease's initial symptoms. Early senescence in leaves with severe infection. The presence of cinnamon-brown, echinulate urediniospores characteristic of *P. tritricina* was verified by microscopic analysis.

### C. Farmer Awareness and Practices

Merely 32% of farmers were able to accurately identify the indications of rust. 58% used seeds that had been preserved from earlier harvests. Fungicides were used by 21%, mostly triazoles like propiconazole, although frequently without the right time.

### D. Management Strategies

**Resistant Varieties.** When compared to previous cultivars, the use of leaf rust-resistant types like PBW 826, PBW Zn 1, and WH 1105 decreased rust incidence by more than 90%. However, because of awareness and seed availability, access and adoption are still restricted. **Fungicide Applications.** Trial plots treated with propiconazole (0.1%) at the flag leaf stage and again after 15 days demonstrated a yield boost of 10–15% and a considerable reduction in illness (less than 2% severity).

**Integrated Management.** The most successful approach combined field sanitation, timely fungicide application, seed renewal every two to three years, and resistant cultivars.

## CONCLUSIONS

Due in major part to the ongoing cultivation of vulnerable types, inappropriate fungicide application, and a lack of farmer education, wheat leaf rust continues to pose a danger in Ropar. However, with coordinated approaches, the illness is manageable.

## KEY RECOMMENDATIONS

1. Encourage resistant wheat cultivars by distributing and subsidizing certified seeds.
2. Teach farmers how to recognize diseases and when to use fungicides.
3. Create mobile-based alerting and disease forecasting systems.
4. Sustainable disease management requires a concerted effort by farmer cooperatives, research institutions, and government extension services.

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**How to cite this article:** Navjeet Kaur and Prof. (Dr.) H.K. Sidhu (2025). Wheat Leaf Rust: Incidence, Impact, and Management in Ropar District. *Biological Forum*, 17(11): 17-18.