Advances in Applied Science Research
ISSN: 0976-8610+non

Open Access Commentary

Wheat Stem Rust its Life Cycle and Management

Prakash Awasthi*

Department of Plant Pathology, Institute of Agriculture and Animal Science, Tribhuvan University, Kirtipur, Nepal

DESCRIPTION

Stem rust of wheat is caused by *Puccinia graminis* tritici that cause devasting loss in global wheat production since its emergence. Stem rust of wheat is named for its characteristics powdery reddish brown rusty colored crystal of pustules developed in the leaves and stem of weak and susceptible plants that are generally grown on condition that favor pathogen survival and infection. These powdery structures present on the infected plant part are the spores of fungus *Puccinia graminis* that cause stem rust.

Generally *Puccinia graminis* is a macrocyclic fungi *i.e.* it complete its life cycle in different stage of development. Also it is a heteroceous fungus as it requires two hosts for multiplication or life cycle completion.

- Wheat plant (Main host)
- Barberry plant (Alternate host)

The Uredial and Telial stage occur in wheat because of their diploid nuclei whereas Pycnial and Aecial stage on Barberry plant because of their haploid nuclei.

Its dominance in crop or its highly affecting chance in crops occurs during winter season. Yield loss due to this pathogen is found about 60-70%.

Symptoms

Wheat plant:

- Characteristics symptom is the presence of Uredine on plant which is brick red, elongated blister like pustules that are easily shaken off.
- Most frequently occur in leaf sheaths but are also found on stems, leaves, glumes and awns. On leaf sheaths and glumes pustules rupture the epidermis giving a ragged appearance.
- When the Uredospore dies teliospore are produced which produce black telia.
- In severe infections the diseased plants are stunted and produce small spikes and shriveled grains or no grain at all.

Barberry:

- Appearance of honey dew in Aceciospore stage of lifecycle.
- Production of orange or yellow or peach color structure called aceciospore.
- Microscopically Aceciospores have a slightly warty surface.

Life Cycle

Puccinia graminis has a complex life cycle. Its life cycle completes in different stages. These stages occur on both wheat plant and Barberry plant.

- **Uredospore:** Uredospores are produced within pustule. A single pustule can produce 10-1000 number of uredospore. This uredospore is capable of infecting weak plant. The uredospore attack the host tissue (leaves, stem) and enter inside the host. Once these uredospore enter inside the host they extracts/absorb food from the weak plant cells and it start to grow there forming mycelium of uredospore which covers the whole tissue or leaf where it develops. As a result the leaf changes to red color, damaged texture and show powdery appearance. Once the mycelium gets mature a pressure is created on the leaf epidermis due to presence of large mass of uredospore. The epidermis is then ruptured due to the pressure (since pressure is less outside) uredospores comes out from the ruptured part. When releases and get healthy contact with air they get transformed to another leaf or plant.

Received:	25-July-2023	**Manuscript No:**	AASRFC-23-17120
Editor assigned:	27-July-2023	**PreQC No:**	AASRFC-23-17120 (PQ)
Reviewed:	10-August-2023	**QC No:**	AASRFC-23-17120
Revised:	10-January-2025	**Manuscript No:**	AASRFC-23-17120 (R)
Published:	17-January-2025	**DOI:**	10.36648/0976-8610.16.1.054

Corresponding author: Prakash Awasthi, Department of Plant Pathology, Institute of Agriculture and Animal Science, Tribhuvan University, Kirtipur, Nepal; E-mail: prakashawasthi82@gmail.com

Citation: Awasthi P (2025) Wheat Stem Rust its life cycle and management. Adv Appl Sci Res. 16:54.

When the growing season ends *i.e.* in the month of March-April when the atmosphere temperature is high uredospore dies. In this stage instead of producing more uredospore it begin to produce black overwintering spore called Teliospore.

- **Teliospore:** When temperature of the surrounding increases then the teliospore gets mature. When teliospore matures then the two nuclei are fused and a diploid nuclei is formed. The benefit of diploid nuclei to this pathogen is that it can survive in unfavorable condition, dormant or resting stage in the soil. As the temperature range lowers teliospore dormancy is breaked and next stage of life cycle proceed to Basidiospore.
- **Basidiospore:** When favorable condition arises then their protoplasm gets activated. When gets activated, basidium is grown outwards of the protoplasm through germ pores. Basidium now obtain diploid nucleus of teliospore as a result meiosis division occur there now. Result of meiosis division produce 4 haploids nucleus. Again in basidium further outgrowth structure is seen which the basidiospore. The nucleus is then transported to the basidiospores. This process complete in barberry plant leaves (because of haploid nuclei).
- **Pycnidiospore:** When basidiospores reaches to Barberry leaves they make germ tube by which they attack epidermis of leaf and slowly they make intracellular mycelium that later forms spermagonia (Pycnia here Pycnidiospores are formed). These Pycnidiospores contain haploid spermatia and receptive hypae. When pycnia matures it secrete a juicy pigment (honey dew) in which the insect feed. When the insect feed on the juice either of haploid spermatia or receptive hypae gets attached to the body of insect. When the same insect attack another pycnia then there occur fertilization as a result diploid nucleus is developed. In this stage entire nobel genetic combination is achieved. (This stage also occurs in barberry leaves).
- **Aceciospore:** Once fertilized the hypae grow down towards the lower epidermis where they form monokaryotic mycelium which later produce acedium which consists of aceciospore which are peach or orange color structure. When favorable condition arises these acediospores brust the lower epidermis of Barberry leaf and again they directly infect wheat plant producing the brown red uredospores that are the hallmark of these disease.

Epidemiology

- Wheat stem rust is supported by high temperature *i.e*. 25-30°C and mild nights *i.e.* 15°C-20°C.
- High RH also favors stem rust.
- Infection occurs through natural opening *i.e.* stomata.

Management

- Adjust sowing time. Early maturing varieties also help to avoid pathogen growth.
- Avoid excess use of Nitrogenous fertilizer.
- Grow resistant varieties like Sonalike, NP 700 and 800, Safed lerma.
- Spray twice or thrice with Zineb at 0.25% or Mancozeb at 0.25% at 15 days interval.
- One of the best management practices is to study not only primary host but also investigating the functionality of alternative host and utilizing the knowledge of complete life cycle of this pathogen to limit its emergence and survival of new virulent races.