

Wheat Rust

Fourth century Roman God: Robigus

Holiday: Robigalia

Rusts are among the earliest known disease of crop plant. Three different types of rusts are commonly infecting wheat.

(i) Black or stem rust
C.O.: *Puccinia graminis* f. sp. *tritici*

(ii) Leaf, Brown or Orange rust
C.O.: *Puccinia recondita*

(iii) Yellow or stripe rust
C.O. : *Puccinia striiformis*

Class : Basidiomycota
Order : Uredinales
Family : Pucciniaceae



Black Rust

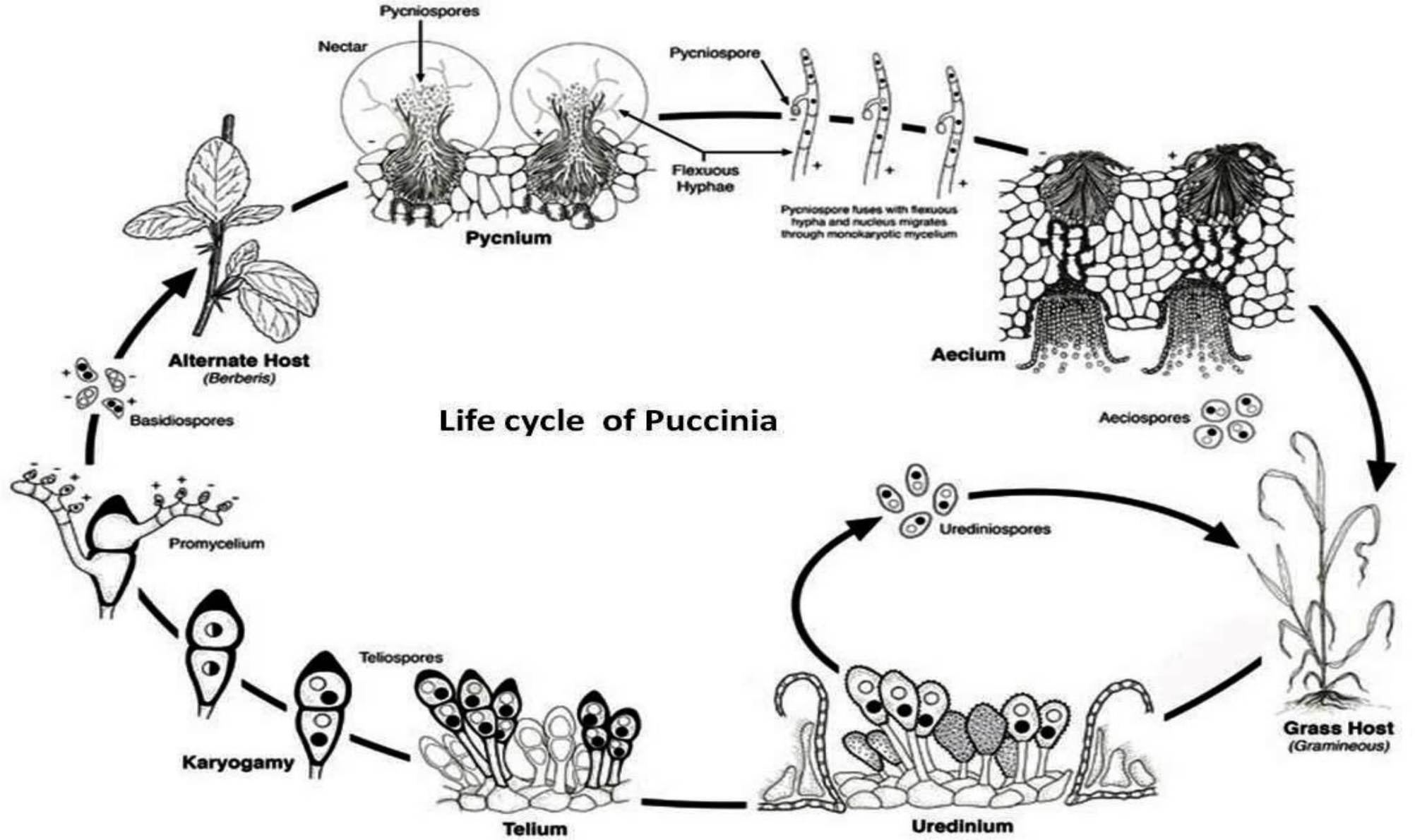
- In India black rust occurs almost in all area. In Northern India it appears during March whereas it appears in November/ December in Southern part of India.
- The fungus is obligate parasite living only on host plant.
- In India 26 races (biotypes) have been reported.
- Races 11, 15C, 34-4 & 122 are most predominant and virulent.
- New Race from Uganda reported recently-UG99

Symptoms:

- The first symptoms is flecking of leaves, leaf sheath, culms and floral structures.
- These flecks are the uredosori, which soon develop as oblong, reddish-brown pustules, frequently merging into one another, finally bursts to release brown uredospores and covers an entire leaf blade forming brownish appearance.
- Later in the season, teleutosori are produced, often merging with one another to cause linear patches of black lesions which account for the name black rust.
- On maturity teleutosori burst open, exposing mass of black spores.
- In severe infection diseased part remain stunted, produce small spikes and shriveled grains or no grain at all.



Uredospore
Teliospore
Basidiospore
Aeciospore
Pycniospore



Disease cycle:

- ✓ It is heterocious, full cycle rust requires more than one host to complete life cycle.
- ✓ The uredo and teleuto stages occurs on wheat, barley and some grasses and the pycnidial and aecial stages on species of Barberis and Mahonia, an alternate host.

Uredospores:

- ✓ Brown, oval shaped, thick walled marked with thin short spines.
- ✓ They borne singly on stalks and germinate in water by germ tubes.
- ✓ Upon infection the fungus produced uredosori, which release the uredospores.
- ✓ As the disease advance same mycelium in host produces teleutospores either in uredosori or in teleutosori.

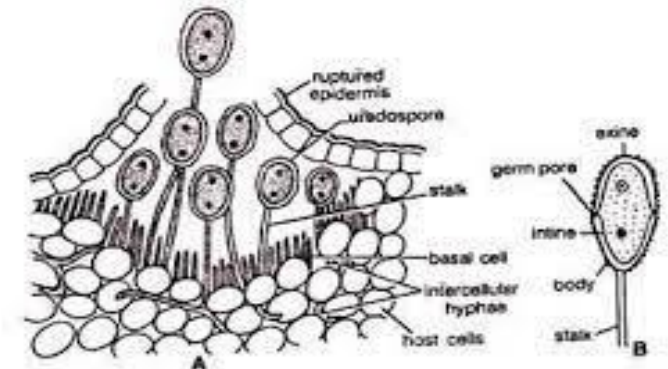


Fig. 4 (A-B). *Puccinia graminis* : T.S. wheat leaf passing through a uredosorus, (B) A uredospore

Teleutospores:

- ✓ Dark, chestnut brown, two celled, thick walled, smooth, rounded or pointed at the apex.
- ✓ They germinate by producing a long, four celled promycelium called basidium on which four basidiospores are produced.
- ✓ Germinate by germ tube and infect the alternate host barberry.
- ✓ Later on produced pycnia mostly on upper side of leaf surface.

Pycnia:

- ✓ Flask shaped with narrow opening produce numerous pycniosporophores.
- ✓ At the tip of pycniosporophores small thin walled pycniospore (spermatia) is produced.
- ✓ Pycniospore push out and mixed with honey like fluid which attract insects and that transfer to receptive hyphae projecting from pycnia.
- ✓ Both fuse leading to fertilization and diploidization called spermatization followed by formation of aecial primordia on lower leaf surface.

Aecia:

- ✓ Cup like aecia arise from diploid aecial primordia.
- ✓ From the base of aecium numerous aeciospores are produced in chain.
- ✓ They are capable of infecting host wheat, barley and grasses leading to production of uredosori; the repeating stage.
- ✓ The possibilities of the fungus to survive on self sown wheat, certain grasses growing in cool regions particularly at altitudes upto 2000 mt. in Himalaya or in Nilgiris Hills.

Favourable conditions:

- Temp. below 30°C.
- Cool condition.
- Optimum temp. 17-18°C during March-April in Northern India and November-December in Southern India.

Management:

- Adjusting sowing date, to escape the crop from disease.
- Application of balanced fertilizers.
- Spraying of zineb-zinc sulphate combination 4-5 times @ 1 kg / 450 lit. of water/acre during crop season controls the black and brown rust.
- Seed dressing with plantvax protects seedling for about 7 weeks from rust.
- Two sprays of carboxin 1% at later stage of plant growth give good control.
- N.P.700 and N.P. 800 are resistant to all three rusts.
- Lerma Rojo, Safed Lerma and Sonalika are highly resistant varieties to all the three rusts.

(ii) **Brown or Orange Rust**

C.O. : *Puccinia recondita*

It is also heterococious rust.

The uredial and telial stages appearing on wheat and some other grasses and the aecial and pycnidial stages on species of *Thalictrum* sp.

Symptoms:

The first symptom of the disease is the appearance of minute, round, orange sori produced irregularly on leaves.

The sori turn brown with maturity.

Telial stage may form in the same pustule.



(iii) Yellow or Stripe Rust

C.O. : *Puccinia striiformis*

- ✓ It is **heterocious rust**, with uredial and telial stages occurring on wheat and a few related hosts such as *Agropyron semicostatum*, *Bromus catharticus*, *Hordeum murinum*.
- ✓ No alternate host for the fungus is known.

Symptoms:

- Uredosori appears as bright yellow pustules on leaves.
- Elongated sori arranged in linear rows hence named as stripe rust.



Black rust	Orange rust	Yellow rust
<i>P. graminis</i>	<i>P. recondita</i>	<i>P. striiformis</i>
Stems are mostly affected followed by leaf sheath, leaves and ears	Leaves are mostly affected followed by leaf sheath and stem	Leaves are severely affected followed by stems and leaf sheath
First noticed in March April	First noticed in January	First noticed in January
Uredospore are rusty red in colour	Uredospore are Orange	Uredospore are lemon yellow
Uredospores are oval with four germ pores	Uredospores are round with 7-10 germ pores	Uredospores are round with 6-10 germ pores
Pycnia and Aecia are formed on Berberis and Mahonia	On Thallictrum and Isopyron	-
240 races known 14 in India	100 races known 14 in India	14 races known 10 in India

Loose Smut of wheat

Loose smut disease often causes severe damage, destroying up to 40% in a certain locality but overall loss is around 2-3 per cent.

C.O	: <i>Ustilago nuda var. tritici</i>
Class	: Basidiomycetes
Order	: Ustilaginales
Family	: <i>Ustilaginaceae</i>

Symptoms:

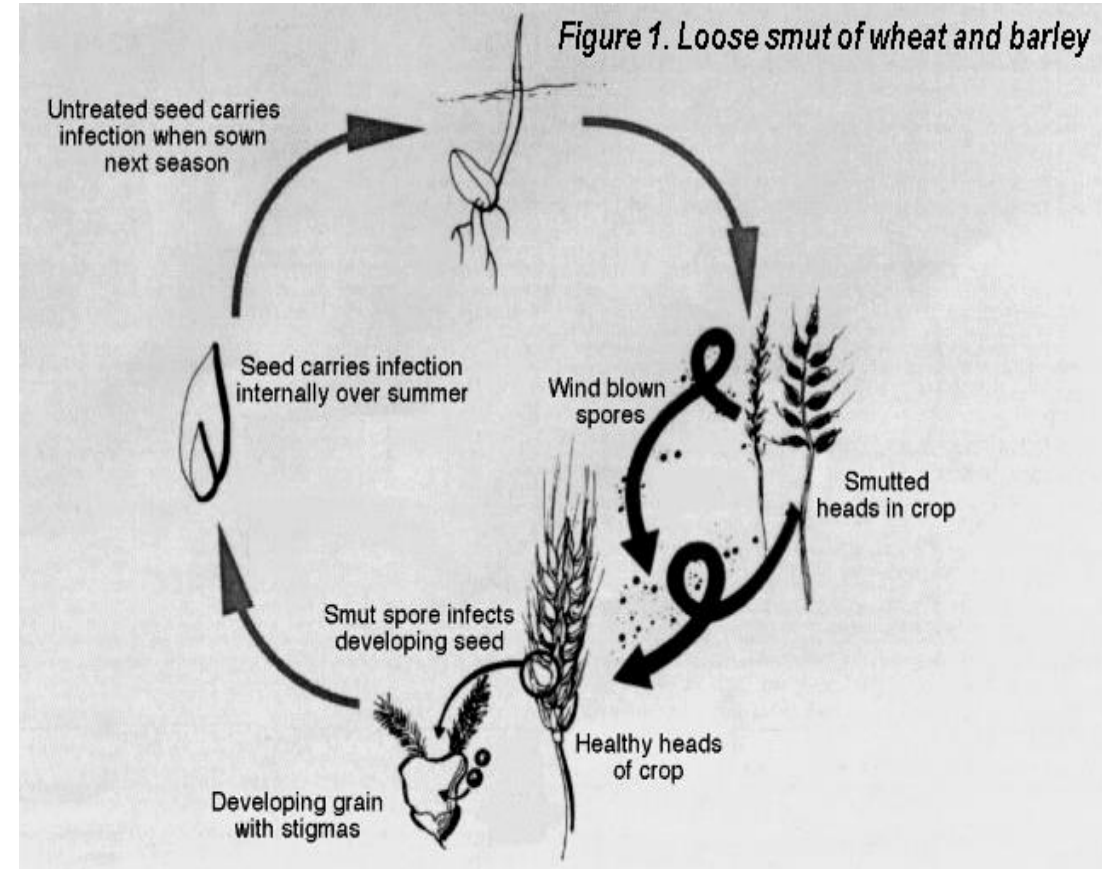
- It appears **at the time of ear head formation.** Until it is difficult to differentiate between healthy and diseased plant.
- **Smuted head emerge earlier than healthy.**
- Usually **all spikelets are affected.**
- **All kernels transformed into smuted mass consist of olive spores.**

Smuted kernels are covered by **grayish silver membrane,** which soon burst **and release black spore mass and liberate through wind leaving rachis.**



Disease cycle:

- ✓ Pathogens overwinter as dormant mycelium in cotyledon of infected kernels.
- ✓ When infected kernels begin to germinate, the mycelium activates and grow intercellularly in seedlings till it reaches to ear head formation.
- ✓ Mycelium enters young spikelets and establish in seed embryo.
- ✓ After infection convert into black teliospores.
- ✓ Secondary spread: Teliospore liberates in air and lands on flowers, germinates through stigma and through ovary wall, establishes in seed embryo and remains dormant.



Favourable conditions:

- Temp. 18-20 degree C
- High humidity (60-85 %) during flowering

Management:

- Hot water treatment at 20 degree C for 5 hrs. then transferred into 49 degree C for about 1 min. and again 52 degree C for 11 min and immediately place in cold water.
- Seed treatment with vitavax or benlate @ 2.5 g. or carboxin or carbendazim @ 2 g./kg of seeds.
- Solar treatment: Soak the seeds in cool water for 4 hrs. followed by spreading and drying of seeds in bright sun (44 degree C) for 4 hrs. in the afternoon(Given by Dr. J. C. Luthra).
- Use resistant varieties: Kalyansona, WG-307, C-302, PV-18

Karnal Bunt

There are three bunts:

1. Stinking bunt : *Tilletia caries*
2. Dwarf / Hill bunt : *Tilletia foetida*
3. Karnal bunt : *Neovossia indica*
C.O. : *Neovossia indica*
New name : *Tilletia indica*

Symptoms:

- No symptoms are seen until the ear head emerges.
- Infection confined to the few grain in the spike and arrangement is irregular.
- As the grain matures, outer glumes spread out and inner expand, exposing bunted grains.
- Bunt ball bursts and expose mass of spores resulting into bunt smell.

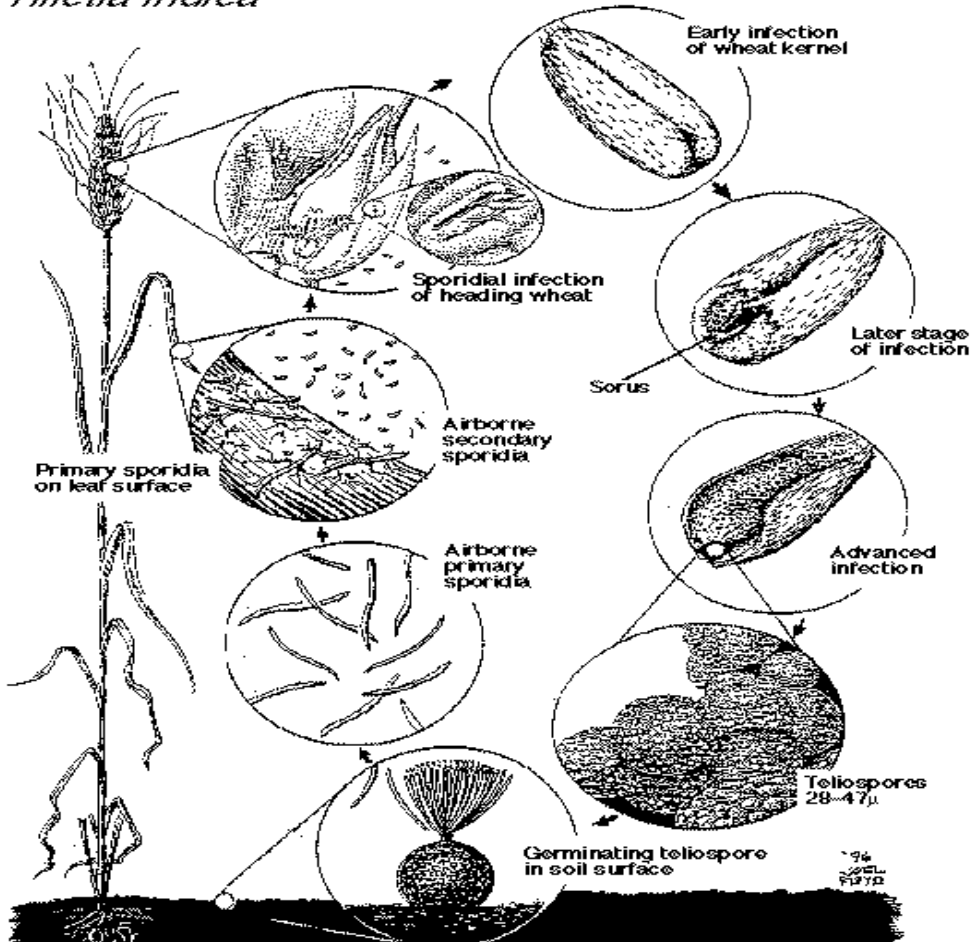


Disease cycle:

- ✓ Primary source: smut spore germinate in the soil producing a large number of needle shaped primary sporidia (primordia) and sickle shape secondary sporidia.
- ✓ Secondary spread: air borne secondary sporidia infect ovary.

Karnal Bunt Life Cycle

Tilletia indica



Management:

- Seed treatment with carboxin, thiophanate methyl, triadimephon @ 2 g./ kg of seeds.
- Use disease free seeds.

Powdery Mildew of Wheat

Erysiphe graminis var. *tritici*

- Fungus produces septate, superficial, hyaline mycelium on leaf surface with short conidiophores.
- The conidia are elliptical, hyaline, single celled, thin walled and produced in chains. Dark globose cleistothecia containing 9-30 asci develop with oblong, hyaline and thin walled ascospores.



Symptoms

- Greyish white powdery growth appears on the leaf, sheath, stem and floral parts. Powdery growth later become black lesion and cause drying of leaves and other parts.



Disease cycle

Fungus remains in infected plant debris as dormant mycelium and asci.

Primary spread is by the ascospores and secondary spread through airborne conidia.

Management

Planting mildew resistant varieties is the most economical way to control powdery mildew.

Powdery mildew thrives in fields with high rates of nitrogen. Nitrogen not only promotes tiller formation, causing dense stands, but also increases the susceptibility of the crop.

Spray Wettable Sulphur 0.2% or Carbendazim @ 500 g/ha

Leaf blight

Alternaria triticina

Reported by **Prasad** and **Prabhu** in 1962 from India.

Symptoms

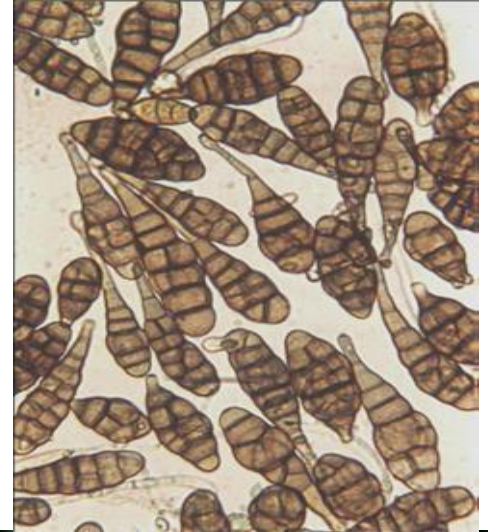
Reddish brown oval spots appear on young seedlings with bright yellow margin.

In severe cases, several spots coalesce to cause drying of leaves. The young leaves are not usually infected.

Heavily infected fields display a burnt appearance even from a distance.

Pathogen

Fungus produces light brown coloured multicellular conidia, with 1-10 transverse septa and 1-5 longitudinal septa, singly or in chains (2-4).



Disease cycle

Pathogen over summers in plant debris and soil.

Primary spread is by **externally** and **internally** seed-borne conidia.
Secondary infection is mainly through wind-borne conidia.

Favourable Conditions

Temperature of 25 degree C and high relative humidity favours the disease.

Management

Soak the seeds in water for 4 hrs followed by 10 min. dip in hot water at 52 degree C.

Grow resistant varieties like Co.25, Sonalika, Arnautka, E6160 and K7340.

Spray the crop with [Mancozeb@0.25%](#) or [Zineb@0.25%](#)

Ear Cockle / Tundu Disease of Wheat

This disease has been reported from Punjab, Haryana, U.P. and Rajasthan

First reported and discovered by Needham, 1743.

Causal organism: combined action by

Nematode : *Anguina tritici*

Bacteria : *Clavibacter tritici*

Symptoms:

The characteristics symptoms are yellow slime on stem and inflorescences, which dries up to form sticky yellow layers and cause curling and twisting of spikes.

Most of the grains are replaced by galls formed by the nematodes and these galls carry causal bacterium.



Fig :- Healthy v/s Diseased Earheads

Disease cycle:

- ✓ Juvenile enters into inflorescences and become adult in seed.
- ✓ Each seed contain 80 or more adults of both sexes.
- ✓ Nematode carry bacterial cell on their body from germination of seedlings to the inflorescences and thus both appear together.

Management:

- 20% common salt solution to separate out the floating galls and seeds are then washed with clean water to remove traces of salt for proper germinability.