

## Diseases and Pests of Wheat and Barely

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### Introduction

Wheat plays pivotal role in the food and nutritional security in world, the centrality of wheat ensures national food and nutritional security in India too. Therefore, even amongst the major food crops, wheat contributes maximum towards nutritional security in India. Meantime, an all-time high production of wheat (99.7 million tons during 2017-18) not only ensures food security but also provides substantial scope for value addition and export supports other countries in exigencies.

Barley was one of the first cultivated grains, particularly in Eurasia as early as 10,000 years Ago. Globally 70 per cent of barley production is used as animal fodder, while 30 per cent as a source of fermentable material for beer and certain distilled beverages, and as a component of various foods. It is used in soups and stews, and in barley bread of various cultures. Barley grains are commonly made into malt in a traditional and ancient method of preparation. In 2017, barley was ranked fourth among grains in quantity produced (149 million tones or 330 billion pounds) behind maize, rice and wheat.

Agriculture in 2050 will need to produce about 50 per cent more food because of the increase in the world population and the change in diets (FAO, 2017). Wheat production should increase, as it is one of the main staple crops in the world, providing 20 per cent of calories and proteins for human nutrition (Tilman et al., 2011); this growth will be mainly based on yield increases, as there is strong competition for scarce productive arable land from other sectors in society (FAOSTAT, 2020). Future demand will need to be achieved through sustainable growth combining integrated management of diseases and pests, adaptation to warmer climates and increased frequency of abiotic stresses, and reduced use of water and

other resources. Among the biotic constraints, Savary et al. (2019) estimated that 21.5 per cent of current yield losses are due to biotic stresses via diseases and pests.

### Diseases of wheat:

#### 1. Rust

S.No.	Common Name	Causal Organism	Alternate host
01	Black/Stem Rust	<i>Puccinia graminis f.sp.tritici</i>	<i>Berberis vulgaris</i>
02	Brown/Lea fRust	<i>P.recondiata f.sp.tritici</i>	<i>Thalictrum polygonum</i>
03	Yellow/Stripe Rust	<i>P.striformis</i>	<i>Bromus juponicus</i>

**Management:** Grow only the latest rust resistant varieties like: Karan Narendra (DBW222), Karan Vandana (DBW 187), WB2, DBW93, etc. (Varieties released by IIWBR). Spray Propiconazole 25 EC as soon as symptoms of the disease appear.

#### 2. Loose Smut: *Ustilago nuda f.sp. tritici*

**Symptoms:** Affected ear on diseased plants emerges out the flag leaf earlier than the healthy plants. All spikelet affected and transformed into black powdery mass of spores covered with thin silvery membrane that burst as soon as affected ears emerges from host leaf. The olive brown black spores are easily blown away leaving naked rachis behind.

#### Management:

- This is externally and internally seed borne disease, some treatments should be given.
- Hot water treatment (Jensen's treatment): Soak the seeds in water for 4-6 hours at 54 oC. Dry it and treat with seed protectants.
- Solar treatment/Sun exposure (Luthra's treatment): on galvanized iron sheets.
- Seed treatments with systemic fungicides carboxin, vitavax 2g/kg of seeds or carboxin + carbendazim 2.5g/kg Of seeds.
- Use of resistant variety for sowing like: PV-18, WG-307, Hd-450, Kalyan Sona etc.

#### 3. Kernal Bunt: *Neovossia indica*

**Symptoms:** This disease is very difficult to detect in standing crop, it detected only after threshing. The diseased grains partially or completely turn into black powder mass enclosed by the pericarp and later rupturing the pericarp exposing the black powder. Infections is usually confine to few grains in the spike with irregular arrangements.

**Management:**

- Seed treatment with copper carbonate or thiram @ 3g/kg of seeds. Or with a combination of vitavax and thiram is very effective.
- Use of tolerant varieties: WL-1502, HD-2281 and resistant varieties: HD-2329, HD-20 and HD- 29, and use certified seeds. Intercropping with gram and lentil.
- Spray (Propiconazole 25 EC or Tebuconazole 25EC) 0.1% of the solutions in 50% of wheat after the earrings emerge.

**4. Foliar blight: *Alternaria sp.***

**Symptoms:** Small, dark brown spots of 1 to 2 mm on the leaves and gradually spread over the entire leaf. In a favorable environment, the infected leaves become scorched and the size of the grains shrinks and the color of the grains becomes light brown.

**Management:**

- Grow only the latest rust tolerant vines approved for the area. Do not plant one variety in more than one area. Inspect the fields and pay more attention to the crops grown around the trees.
- Propiconazole 25 EC as soon as symptoms of the disease appear. or tebuconazole 25 EC. And make a 0.1 percent solution and spray it.

**Pests of wheat:**

- 1. Termites: *Odontotermis obesi* and *Microtermes obesi* (F: Termitidae; Order: Isoptera)**

**Nature of Damage:** As pupation takes place in soil, workers of the termites feed on the roots and stem parts first. This results in drying of the plants. They feed on bark of the plants.

**Management:** Destroy termitoria by digging out. Use CS<sub>2</sub> Methyl Bromide/ CS<sub>2</sub> + Chloroform Use chlorpyriphos 2L/ha.

- 2. Armyworm: *Mythimna separata* (Family: Noctuidae; Order: Lepidoptera).**

**Nature of Damage:** The primary symptoms are defoliation of plants. Larva feed on leaves as oviposition on leaves and in batches, chewing from the edges to the midrib, or on the head of cereal plants. Heavy infestations can be very destructive; larvae may climb the plant and sever the neck just below the head. The armyworm feeds during dawn and dusk period as it is shy of sun light.

**Management:** Use of light & pheromone traps. Digging of trenches and dusting with Methyl Parathion 2D @ 20kg/ha.

**3. Pink Borer: *Sesamia inferens* (Family: Noctuidae; Order: Lepidoptera)**

**Nature of Damage: Dead hearts:** The young larva hatching from the egg, bores the stem, resulting into the death of central shoot in early stage of crops. Formation of empty white ear heads.

**Management:** Removal and destructions of stubbles after harvest of the crop to kill hibernating larval stages. Removal of affected shoots/ dead hearts and burn them. Spray with 0.2% carbaryl immediately after the incidence is noticed.

**4. Jassids: *Erythroneura jaaina*; *Typhlocyba maculifrons* and *Amrasaca* spp.**

**Family: Ceicadellidae; Order: Hemiptera**

**Nature of Damage:** Both nymphs and adults suck the cell sap from undersurface of leaves. As a result of their feeding white or yellowish specks are noticed on the leaves. In case of severe infestation leaves turn silvery white and dry.

**5. Aphid: *Sitobian avenae* (Family: Aphididae; Order: Hemiptera) Aphids reproduce viviparously and parthenogenetically.**

**Nature of Damage:** Both nymphs and adults suck the cell sap from leaves and the tender shoots and impair the vitality of plant. Besides sucking the sap from the plant, they also excrete honey dew secretion which attract the black sooty mold adversely affecting photosynthesis. In case of severe infestation entire plant may be covered by pest showing blacking appearance.

**Management: (Both Jassids and Aphids):** Spray 200-250 gm a.i./ha of Dimethoate or Oxydemeton methyl. Dusting with carbaryl 10D@20kg/ha as soon as incidence is notice.

**Diseases of Barley:**

**1. Covered smut: Causal organism: *Ustilago hordei***

**Symptoms:** Smutted heads. All the ears and the grains are infected. Grains replaced by black agglutinated spore mass (teliospores) covered with a tough creamy skin (peridium) which persists un-till threshing. The hard spore balls of covered smut are very common in soils of untreated plots harvest. Ratoon crops exhibit higher incidence of disease. Externally seed borne disease.



**Management:** Certified smut-free seed should be procured. Resistant varieties: K 12, C.N.-294, C 84. Hot water treatment of seeds. Seed dressing with Agrosan GN @2.5g/kg seeds. Seed treatment with 1:1 mixture of Thiram + Bavistin or Vitavax @ 2.5g per kg or 1gm Raxil/kg seed or Tebuconazole @ 1g/ kg of seed at time of sowing.

## 2. Loose Smut: Causal Organism: *Ustilago tritici*

**Symptoms:** Smutted head containing black powdery masses. Affected ears usually emerge before healthy ones and all the grains are replaced with a mass of dark brown teliospores. The spores are initially loosely held by a thick membrane that soon breaks releasing the spores onto other heads. Finally, all that remains is bare stalks where the spores once were. The disease is caused by the internally seed borne pathogen and expresses only at the time of flowering. The losses are 100 per cent.

**Management:** Soak the seed for four hours in water and keep it in sunshine for 10-12 hours. Afterwards, store the seeds in a dry place. In the field, collect the smutted ear heads and burn them outside the field. Seed treatment with Vitavax or Bavistin @2g/ kg seed.

## 3. Powdery Mildew: Causal Organism: *Erysiphe graminis var. hordei*

**Symptoms:** Cottony growth on both the leaf surfaces. Symptoms are usually first observed at tillering stage but the disease does not normally persist beyond spike emergence. The upper surface of these patches exhibits chlorotic spots. As the disease progress, these white cottony patches become dull gray- brown color due to development of fruiting bodies (cleistothecia). The infected plants show slow growth.

**Management:** Effective organic fungicides for treating this disease include lime-sulfur, sulfur, neem oil and potassium bicarbonate. Use of baking soda has been seen quite effective according to some farmers.

## Pests of Barley:

**Aphids:** Although it considered as a minor pest of barley, but nowadays aphids can accumulate to extremely high densities during winter seasons. Barley can become infested by four different aphid species. A) Oat or wheat aphid (*Rhopalosiphum padi*) is one of the most common aphids infesting barley crop. Typically, this species colonizes the base and lower portions of the plant. B) Corn aphid (*Rhopalosiphum maidis*) is also a common species found

in winter cereals like barley. It colonizes the upper parts of the plants and rolled up the terminal leaf. C) Rose-grain aphid (*Metopolophium dirhodum*) generally colonizes the undersides of the leaves, high in the canopy. D) Rice root aphid (*Rhopalosiphum rufiabdominalis*) colonizes the roots of the plants under the soil surface, and colonies may be seen from the roots to the base of the plant.

**Symptoms:** Nymphs and adults both suck the cell sap from leaves and persistent infestations can reduce tillering and result in early leaf senescence. Aphid infestations during the grain fill period may result in low protein grain, and infestations throughout the booting to milky dough stage, particularly if aphids are colonizing the flag leaf, stem, and ear, result in yield loss development. Aphids can transmit the Barley Yellow Dwarf Virus in barley.

**Management: Same as Wheat Aphid.**

Note: Aphid populations that may persist after treatment can be effectively suppressed by natural enemies, avoiding the need for additional treatments.

**2. Armyworm:** The most common species are **common and northern armyworm (*Leucania convecta* and *L. separata*), and lawn armyworm (*Spodoptera mauritia*).**

**Symptoms:** Puckering on leaf margins caused by older larvae feeding is a sign of infestation. As the leaves dry and become unpalatable, the larvae target the stem node. The stem is often the last part of the plant to dry. Up to seven heads of barley can be severed by one large larva each day. One larva/m<sup>2</sup> can result in a loss of 70 kg/ha of grain. A larva goes through its final, most harmful instars in 8 to 10 days, at which time crops are most vulnerable to damage.

**Management:** Check the plant for larvae as well as the soil debris beneath the plant. One complete sweep with a sweep net sample corresponding to one crop square meter. Biological control agents such as pathogens, predatory beetles, parasitic flies and wasps may be significant.

**3. Helicoverpa: S. N.: *Helicoverpa armigera* (Family: Noctuidae; Order: Lepidoptera)**

**Nature of Damage:** Young larva first feeds leaves for a while before attacking ear heads. Significant and total hollowing out of internal tissues. While feeding the caterpillar thrust its head inside leaving the rest body outside. They feed on leaves, awns and ear heads.

**Management:** Parasitoids: *Trichogramma chilonis*, *Telenomus spp.* etc. Predators: **Green lacewing, red ants, Coccinellids, Reduviid Bug** etc. Ploughing and Hand Picking would



destroy 70 per cent of pest. NPV of *H. armigera* @250LE/ ha. Spray with 5 per cent NSKE. Spray the crops with 0.05 per cent of quinalphos. Dusting with Malathion 5D/methyl parathion 2D@ 20kg/ha.

#### 4. Blue Oat Mite (*Penthaleus species*)

**Symptoms:** Adults and nymph mites suck leaves resulting in silvering of the leaf tips. Feeding causes fine mottling of the leaves. Heavily infested crops may have a bronzed appearance and leaf tips wither leading to seedling death. Damage is most likely during dry seasons when mites in large numbers.

**Managements:** Check from planting to early vegetative stage, particularly in dry seasons, monitoring a number of sites throughout the field. If pale-green or greyish irregular patches appear in the crop, check for the presence of blue oat mite at the leaf base. Predators of BOM include spiders, ants, predatory beetles and the predatory anystis *mite* and snout mite. BOM are also susceptible to infection by a fungal pathogen (*Neozygites acaracida*), particularly in wet season.

#### References

- ❖ <http://www.aicrpwheatbarleyicar.in/profile/>
- ❖ <https://en.m.wikipedia.org/wiki/Barley>
- ❖ <https://www.frontiersin.org/articles/10.3389/fpls.2021.671060/full>
- ❖ <https://www.daf.qld.gov.au/business-priorities/agriculture/plants/crops-pastures/broadacre-field-crops/insect-pest-management-specific-crops/insect-pest-management-winter-cereals>
- ❖ <https://www.researchgate.net/publication/330497981>