

Major Diseases of Bajra (Pearl Millet) and Their Effective Management

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Pearl millet, *Pennisetum glaucum*, is an annual grass in the family *Poaceae* which is grown widely in Africa and India for its grain which can be used to make flour and other foodstuffs. In India this crop is grown mainly in states viz. Rajasthan, Uttar Pradesh, Haryana and Gujarat. Pearl millet grain can be ground into flour and used to produce porridge, or a type of flat bread. Pearl millet is adapted for growth in dry conditions where there is low rainfall. Pearl millet is propagated directly from seed. It's production and productivity comparatively get less due to some biotic and abiotic factors affecting during crop season. Following important diseases are affect the bajara during cropping season and their detail discussion are follows:

[1] Downy Mildew” or “Green Ear” Disease of Bajra

Causal organism: *Sclerospora graminicola*

First reported from India by Butler in 1907. It is now a major disease of Bajra in Asia & Africa. It is locally known as “*Jogia Rog*”. It caused losses up to 30% in HYV (high yielding varieties) in India. Disease is severe in “ill-drained & low-lying areas”.

Symptoms: - The pathogen causes **systemic infection**. There are two stages of symptoms: -

(i) **Downy mildew stage:** - Symptoms appear as chlorosis of the first to third leaves of the seedlings. White **downy growth** appears on the lower surface of the chlorotic areas.

(ii) **Green ear stage:** - The transformation of floral organs into twisted leafy structures (i.e., Phyllody). This gives an appearance of “**green leafy mass**” hence the name “**Green ear**”. The bristles of the spikelets become **hypertrophied**. Sometimes, only a portion of the ear shows the green ear symptoms & rest of the ear is normal.



A. Downy mildew stage

B. Green ear stage

C. Green ear stage

Disease Cycle: - The pathogen is **seed & soil-borne** (SSB) in nature.

(I) **Perennation / Survival:** - The pathogen survives through “**Oospores**” in diseased parts fall down on the ground and through mycelium in the infected seeds (internally seed-borne).

(ii) **Primary Infection:** -The oospores present in soil germinate & cause primary infection of the underground parts of the seedlings (around 9 days after the crop is sown). The **infection** spreads upward **systemically** along with plant growth.

(iii) **Secondary Infection:** - Sec. infections are caused by zoospores produced by germination of sporangia. Dispersal of sporangia are takes place by means of wind, water & insects to the healthy plants.

(iv) **Pre-disposing factors:** - (I) Abundant air supply & high humidity (90 %). Low soil moisture (i.e., dry soil). Temperature range of 20-25 °C are the most favorable conditions.

Management: - “Use healthy seeds, in healthy soil”. As the pathogen seed & soil-borne:

(A) **Cultural practices:** - (I) Use disease free & certified reeds. (ii) Destroy collateral hosts. (iii) Remove & destruct of infected plant parts (Rouging). (iv) Avoid mono-culturing (Don't grow bajra regularly in a field). (v) Follow deep summer ploughing. (vi) Avoid water-logging in the field.

(B) **Chemical Control:** - (I) Treat the seeds with Apron SD-35 (metlaxyl) at the rate of 6 g/kg seed or mancozeb (2 g/kg/) or thiram (3g/kg). (ii) Spray the crop within one month of sowing with mancozeb (0.25%) or ridomil MZ-72 (0.25%).

(C) **Resistant Var:** - (I) Grow hybrid- “ICMH-88088” (produced by ICRISAT), NHB-10, NH8-14, WCC-75, Pusa-23, Mallikarjun, ICMH-451 etc.

[2] Ergot of Bajra

Causal Organism: - *Claviceps fusiformis* (= *C. microcephala*)

Ergot: - A disease of some cereal crops in which infected grain is converted into hard structure i.e., sclerotia [Ergot means Grains converted into sclerotia].

Ergotin: - An alkaloid obtained from the sclerotia of *Claviceps* fungus is called ergotin/ergotoxin. It has medicinal values (in controlling excessive bleeding during child birth. It is toxic also, to animals & humans (if consumed in excessive quantity) called ergotism disease.

Symptoms: Symptoms appear at the time of flowering. Symptoms appear in two stages:

(I) **Honey-dew stage** – Pinkish or light brown, honey colored sticky fluid exudes from infected spikelets. Honey –dew contains **conidia** of fungus.

(II) **Sclerotia stage** – Small dark brown sclerotia bodies are formed on the ears. These sclerotia replace ovary or grain. These sclerotia (ergots) contain alkaloids responsible for ergot poisoning in animals.

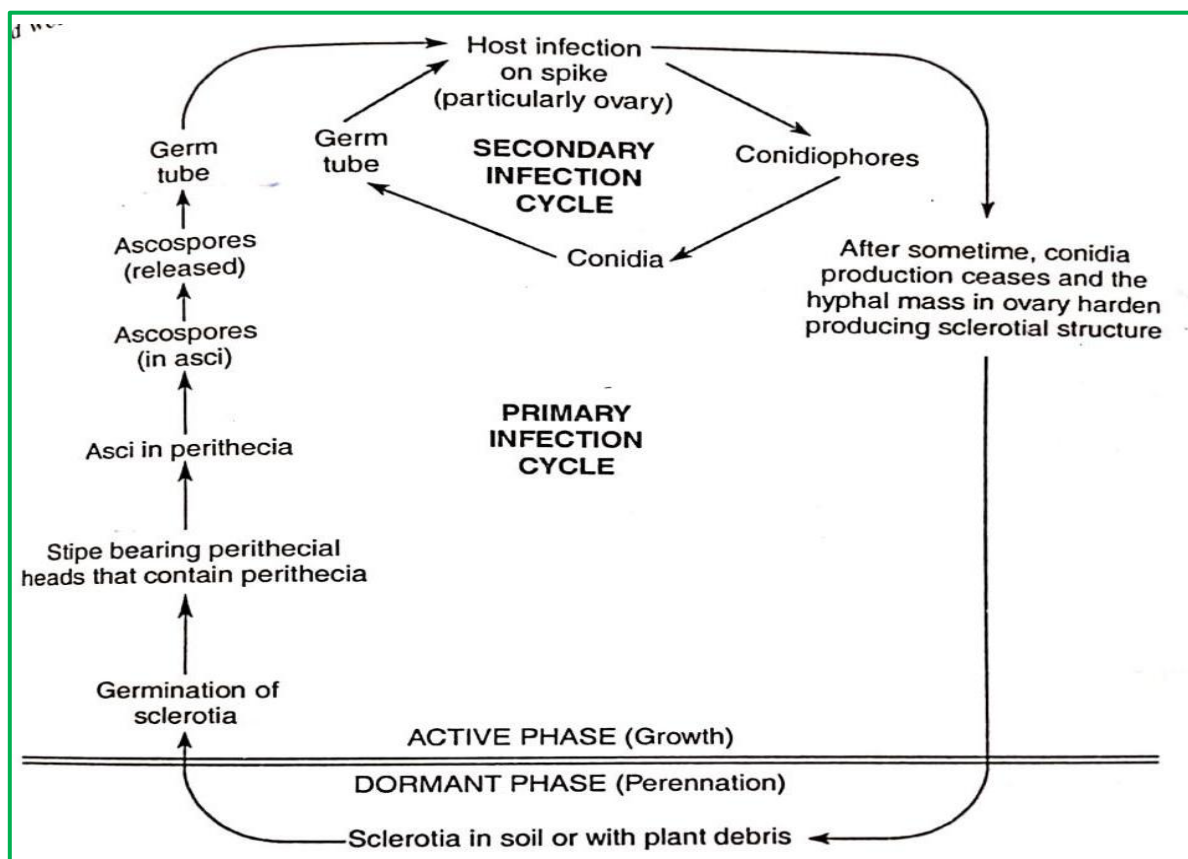


A. Honey-dew stage



B. Sclerotial stage

Disease Cycle: The pathogen is **soil-borne** and **sclerotia admixture with seeds** & infection is air-borne.



Pre-disposing factors: - High humidity (85-95%) during flowering, cloudy weather, low sunshine & daily light showers favor the disease. Rains washed down the pollen & this increased ergot in infection.

Management: - Since the pathogen is **soil – borne**, so follow:

Long crop rotation, Use of sclerotia free seed, Deep summer ploughing, Dipping the seeds in **20 % brine/salt solution**. Since the **ergot infection is local** through air- borne propagules, the control by chemicals is not good feasible. However, somewhat can be reduced.

- ❖ Spray starts just before ear head emergence & repeated 2-3 times at 5-7 days interval. So, spray fungicides like – ziram (0.2%), or copper oxychloride or zineb (0.2%) or Sulphur (0.25%) or Benlate (0.1%) or Bavistin (0.1%) or propiconazole or tebuconazole. Use resistant genotypes like ICI 7517-S-1 & SSC PS -252-S-4 shown high level of resistance. Application of mycoparasite- BCAs (Bio-Control Agents). *Fusarium sambucinum*, *F. semitectum* var. *majus* reduced sclerotia formation & disintegrated them. {**Mycoparasite** means a fungal parasite on another parasite, like *Trichoderma* sp.}

[3] Blast

Causal organism: *Pyricularia grisea* (teleomorph: *Magnaporthe grisea*)

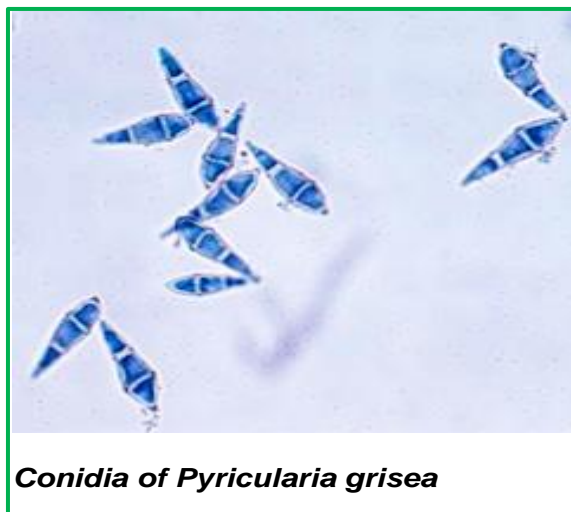
Introduction: Since last some continues years, this disease is become devastating for bajra crop and affect the yield significantly. Blast has emerged as a serious disease affecting both forage and grain production in pearl millet in India.

Symptoms: Infects at any stage of the growth from the seedling to the grain formation stage. The infection appears in the nursery from second week of germination and spread quickly to entire nursery as well as to main field. Small brown circular to elongated spots appear on

leaves which eventually develop into large elongated spindle shaped areas in the seedling stage (Fig.1). Young leaves dry completely in the nursery itself. The spindle shaped spots appear on leaves in the main field. Several spots coalesce and cause drying of foliage. Infection occurs at the basal portions of the panicle branches including the fingers and the ear head breaks away from the stalk. The affected portions turn brown and ears become chaffy and only few shriveled grains are formed. Infection occurs through conidia.



Fig. 1

*Conidia of Pyricularia grisea*

Favourable conditions:

The atmospheric temperatures between 15-25 °C and relative humidity above 85 per cent and also rain splash and irrigation water.

Management:

Cultural method: Use disease free seeds. Grow resistant varieties like CO RA (14), Paiyur (RA)-2, GPU-28, GPU-45, GPU-48, L-5. Proper plant spacing and transplanting is advisable. Early sowing (July month) reduces the blast severity

Biological method: Spray *Pseudomonas fluorescens* (Pf1) at 2 g/lit of water. First spray immediately after noticing the symptom. Second and Third sprays at flowering stage at 15 days interval. Treat the seed with *Pseudomonas fluorescens* @ 6g/Kg seed. Foliar spray with premixture fungicide (Carbendazim+Mancozeb) @ 0.2% concentration at 50% ear head emergence followed by a second spray with *Pseudomonas fluorescens* (Pf1) at 2g/lit of water 10 days later.

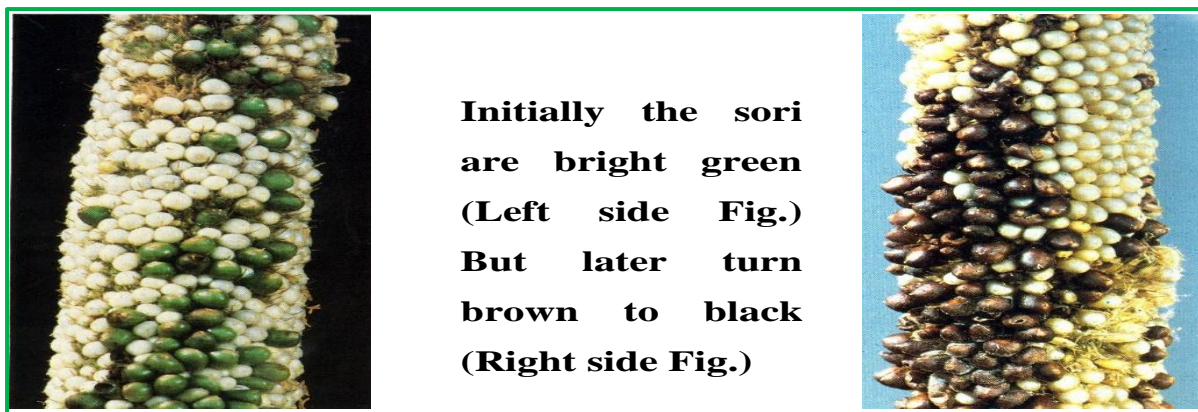
Chemical method: Seed treatment with carbendazim @ 1 gm/Kg of seed. Spray Carbendazim 0.1% in nursery 10-12 days after sowing. Repeat the spray 20-25 days after transplanting and 40 to 45 days after transplanting. Spray any one of the fungicides Carbendazim 500 g or Iprobenphos (IBP) @ 500 ml/ha or premixture fungicide (Carbendazim+Mancozeb) @ 500g/ha. First spray immediately after noticing the symptoms. Second and third sprays at flowering stage at 15 days interval to control neck and finger infection.

[4] Smut

Causal Organism: *Tolyposporium penicillariae*

Introduction: Smut of pearl millet (*Pennisetum glaucum*), is an important and widespread disease. It causes direct loss of grain by replacing them with smut sori, and yield losses of up to 30% have been reported.

Symptoms: The pathogen infects few florets and transforms them into plump sori containing smut spores. The sori are larger than normal healthy grains and when the sori mature they become dark brown releasing millions of black smut spore balls.



Pathogen: The fungus is mostly confined to the sorus. The sori contain spores in groups and are not easy to separate. Each spore is angular or round and light brown.

Disease Cycle:

(I) **Perennation:** The disease is soil-borne. The pathogen perennates through spore-balls that have fallen onto the ground, remain in soil, and overcome the unfavorable conditions.

(ii) **Primary Infection:** The perennating spores germinate at the time of ear formation in the next season. They give rise to sporidia, which are wind-blown and brought onto the florets of the host. The sporidia settle down on the florets, germinate, and quickly cause infection. The latter is always localized. The result of this shoot infection is apparent in the same season when smutted grains appear.

(iii) **Secondary Infection:** Secondary infection may occur on late sown crops or on ear emerging out late.

Predisposing Factors: Disease incidence is higher if conditions are humid. Successive cropping of bajra in the same field also increases considerably the intensity of infection.

Management:

(I) The only control measures recommended strongly for this disease are the removal of smutted ears, use of clean seeds, hot weather deep ploughing, field sanitation, and crop rotation.

(ii) Attempts are required to raise resistant varieties of this crop against smut disease.