

# FUNGAL DISEASES

## DISEASES OF RICE

### Disease symptoms

- 1) Brown spot
  - 1) fungus attacks crop from seedling
  - main field
  - main stage in Bengal paddy
- 2) minute spots on coleophylls, leaf blade, leaf sheath.

3) spots become cylindrical and several spots coalesce and

- 4) several spots on glumes
- 5) dark brown spots on glumes
- 6) picture of seed germination
- 7) reduces grain quality & weight
- 8) 50% yield deduction

in early rice infection - grain filling does not occur. Late water infection - panicle grain filling occurs.

2) Rice Blast 1) disease can infect at all stages of crop growth.

- 2) and in all aerial parts of plant leaves, glumes, nodes, rachis
- leaf blast - blue green lesions on leaf with enlarged in moist weather forming spindle shaped spots with grey centre & dark brown margin.
- Node blast - spots on sheath, leaves & panicle, spots on sheath, husk, glumes appear as brown, all plant parts above nodes die.
- Neck blast - during flower emergence fungus attacks on panicle, leaf, husk, glumes, rachis also called rotten neck. panicle water/neck rot.

### etiology

causal organism Helminthosporium oryzae

fav. condition - 25-30°C → RH above 80% → excess of nitrogen

Pathogen - Bipolaris oryzae

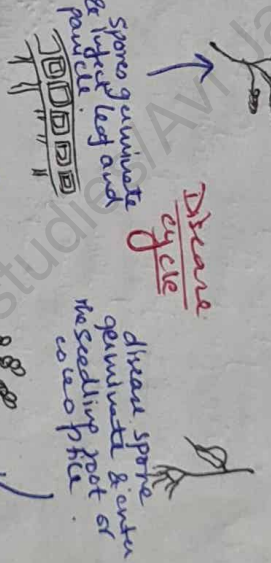
- produces brown septate hyaline
- It produces phytoalexin called oryholin A and oryholin B and I.
- True breakdown in protein & cell wall and cause partial disintegration of cell

CO → Pyricularia oryzae grisea

- fav. condition - cloudy weather, high RH (93-99%), high night temp (15-20°C)
- exerts N application
- availability of collateral hosts
- Pathogen - mycelium is hyaline and septate
- fungus produces perithecia
- conidia produced in clusters on conidiophore

### disease cycle

grain gets infected when disease develops in panicle



disease transmitted by infected seeds

as rice grows, spores formed on leaf spots, from these spores fall blight on leaves & panicles.

spores are airborne & spread disease to other plants

spore produce on current year plants (secondary inoculum)

The blast fungus survives like rice crop on infected rice panicle & seed.

infected rice panicle from last year

infected rice seed (not covered with soil) (Primary inoculum)

### management

- 1) Seed treatment - Thiram or Captan @ 4g/kg.
- 2) Main field spray - Mancozeb @ 2g/l/ha. when grade reaches 3. If necessary repeat after 15 days.
- 3) sprouting & dumping or burn
- 4) use slow release of nitrogen fertilizer
- 5) grow tolerant varieties. viz → CO 44, Bhanu
- 6) field sanitation
- 7) removal of collateral host.

1) Seed treatment - Thiram or Captan @ 2g/kg

2) main field spray - Carbendazim 500g/ha

3) remove collateral host from burnd & channels.

4) use resistant variety CO-47, ADT 36, HDT 39.

5) use only disease free seedling.

6) avoid excess nitrogen

Disease

Symptoms

- 1) fungus affects the crop from tillering to heading stage.
- 2) whitish symptoms noticed on leaf sheaths near water level.
- 3) irregular greenish-grey spots on sheath.
- 4) as spots enlarge, centre  $\rightarrow$  grey-white with blackish brown or purple border.
- 5) lesions on upper parts extend rapidly coalescing each other to cover entire tillers from water line to top leaf.
- 6) infection extends to inner sheath resulting death of plant.
- 7) heavy infection in early heading & grain filling stage  $\rightarrow$  produces poorly fixed grain especially in lower panicles.

4) False Smut

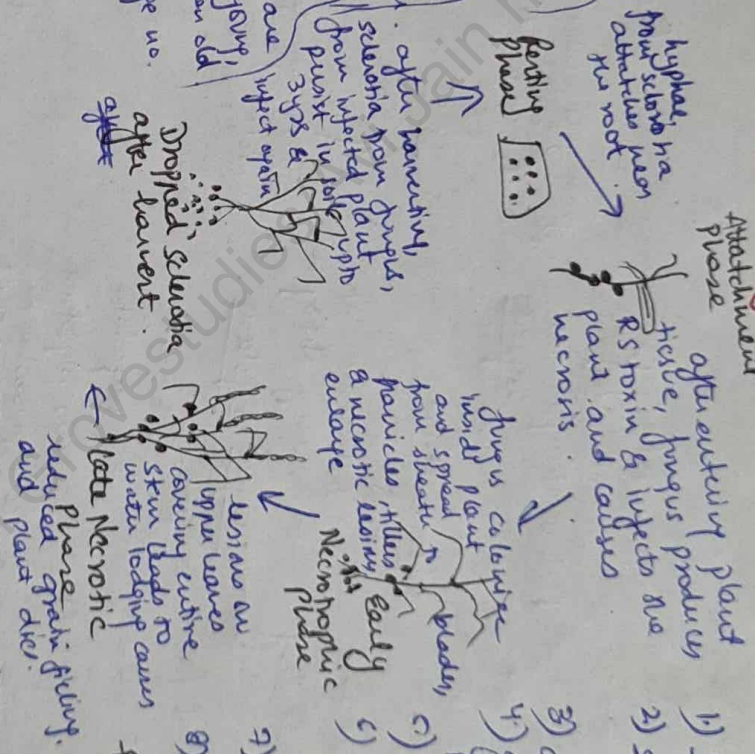
- The fungus transforms individual ovaries / grains into greenish spore balls.
- only few spikelets in a panicle are affected.

etiology

CO-Rhizoctonia solani

- 30-32°C
- RH-96-97%
- closer planting
- heavy dose of Nitrogen fertilizer
- Pathogen - fungus produces sclerotia vegetative which are yellowish when young, yellow-brown when old.
- It produces large no. of sclerotia.

Disease cycle

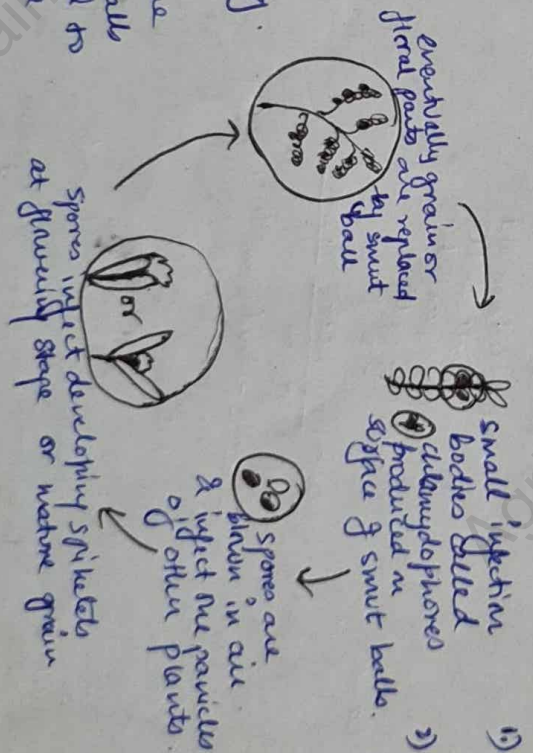


CO-Ustilaginoides vivens

- rainfall & cloudy weather during flowering & maturing.

Pathogen

- cellulose spores are formed as spore balls which are spherical & elongated, warty & oliveaceous.



Management

- 1) Spray carbendazim 500g/ha.
- 2) Seed treatment carbendazim 2g/kg
- 3) avoid excess N.
- 4) grow resistant varieties like Hansavari, Pankaj, etc.
- 5) Deep ploughing in summer.
- 6) check brown plant neigun paprotin.
- 7) avoid using infected seed.
- 8) apply organic amendments near side @ 150kg/ha or FYM 12.5 t/ha.
- 9) No special control measures are necessary.
- 10) grow resistant varieties.
- 11) destruction of straw & stubble from infected plants.
- 12) apply carbendazim & copper bore at tillering & flowering stage.

# Viral Disease of Rice \* BLB and RTV are killer diseases of Rice.

## Disease

## Symptoms

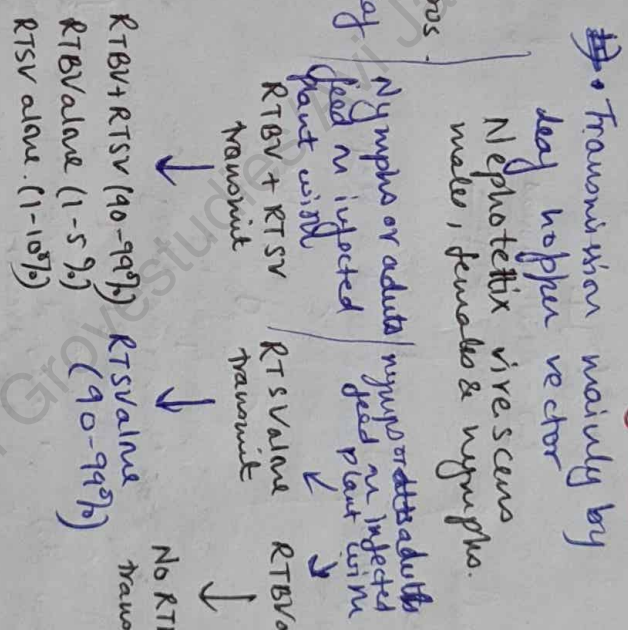
- Rice Tungro Disease (RTD)
- 1) both in nursery & main field
  - 2) yellowing from tip and margin on older leaves, stunted growth, empty glumes
  - 3) poor panicles with dark brown coloration
  - 4) interveinal chlorosis.

## etiology

1) O. Rice tungro bacilliform virus (RTBV) and RTSV spherical virus.

vector - rice green leaf hopper.

## disease cycle



## management

- 1) Spray systemic insecticide Diazinon @ 1.5 kg a/ha
- 2) Rogue out diseased plants
- 3) Stump treatment of seeds with formalin 75% w.p.
- 4) resistant varieties like Viharamaika.

## Nutrient deficiency disease

### Disease

Khaira disease

### Symptoms

- usually in nursery
- chlorotic / yellow patches (TPR) at leaf base on both sides of midrib
- restricted root growth
- main roots turn brown

### etiology

- Zn deficiency.
- It is non-parasitic & non-infectious disease
- Zn deficiency affect plant colour & height

## disease cycle

## management

spray ZnSO<sub>4</sub> 50g/ha + urea 2% in 1000 l of water/ha at sowing time in Zn deficient soils.

# Bacterial Disease of Rice

Bacterial leaf Blight <sup>(BLB)</sup> ⇒ For main disease.

## Disease symptoms

- 1) Bacterial disease at time heading but call blight over earlier also.
- 2) Seedlings → show circular yellow spots in margin leads drying of foliage.
- 3) **Kresk** occurs in early stage (Plant withered & die up).
- 4) In later stage, blight starts from tip of leaves to base (downwards)
- 5) Shows browned yellow
- 6) partially filled grains.
- 7) yellowing bacterial ooze appears on surface which then up into head like incrustations (**ooze test**)
- 8) Problem under poor & Nitrogen deficient soil conditions.

## etiology

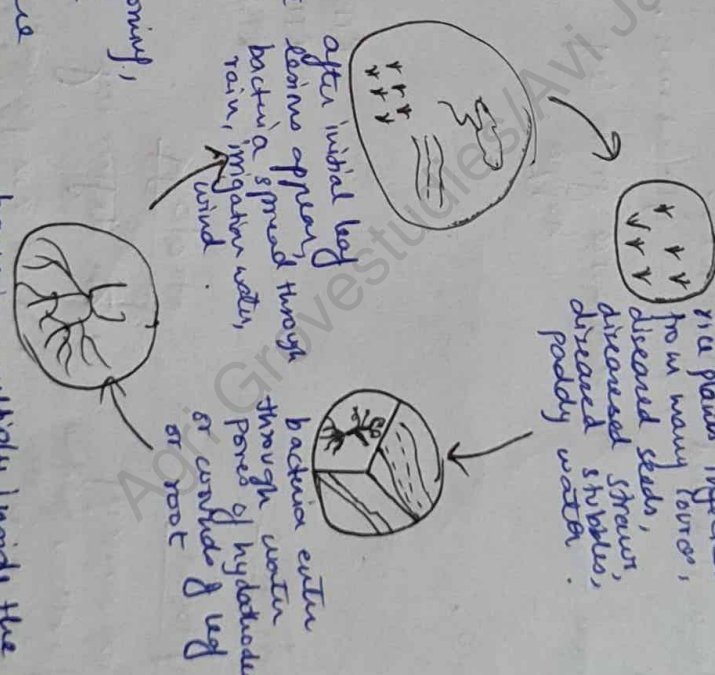
C.O. - Xanthomonas oryzae

**favorable** - severe wind & temp. 25-30°C

- Clipping of tip of the seedling at time of transplanting
- heavy rain, heavy dew, flooding, deep irrigation water.
- excess N especially late top dressing.
- **Pathogen** - bacteria in aerobic, gram -ve; non spore forming, monochitinous flagella
- bacterial colonies are circular, whitish yellow to green yellow colour & opaque.

## disease cycle

pathogen spreads through irrigation water & also through rain showers.



## management

- 1) Burn the stubbles
  - 2) use optimum dose of fertilizers
  - 3) avoid clipping of tip at transplanting
  - 4) remove & weed host
  - 5) avoid flood conditions
  - 6) grow resistant cultivar like IR-20
  - 7) Spray Streptomyces sulphate & terracycline combination seed + copper oxytetracycline 1-25 kg/ha
- High temp & high humidity increases infection.

# DISEASES OF PEARL MILLET (BARI RA)

(*Pennisetum glaucum*)

## Disease

Downy mildew  
OR  
Green Ear Disease

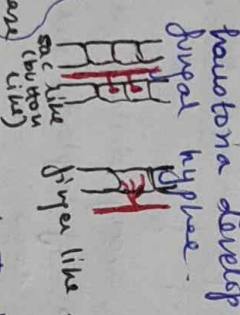
## Symptoms

- 1) Causes reduction in plant height (no. of leaves and nodes).
- 2) Yield of grain & fodder reduced.
- 3) Both systemic & localized infection occurs.
- 4) Mainly systemic & sporophyll or leaves & inflorescence.
- 5) Downy mildew stage prominent on leaves (caused by sporangia).
- 6) Green ear stage affects inflorescence (caused by oospores).

## Etiology

### CO- Sclerospora graminicola

- 1) It is an obligate endoparasite fungus.
- 2) Belong to class oomycetes.
- 3) Mycelium in asexual hyphae.
- 4) These fungal hyphae are found in mesophyll & intercellular spaces & mesophyll cells of vascular bundles of leaves.
- 5) Sac like or finger like haustoria develop from fungal hyphae.
- 6) They penetrate to host cells to absorb nutrients.
- 7) Cell wall of hyphae in germination.
- 8) Parasitic mycelium aggregate in sub-stomatal cavity after growing vegetatively in leaves of host plants.
- 9) Asexual repr. structure sporangia develop into tips of dense mass of fungal hyphae.
- 10) Sporangia are erect, robust and small stalked structure.



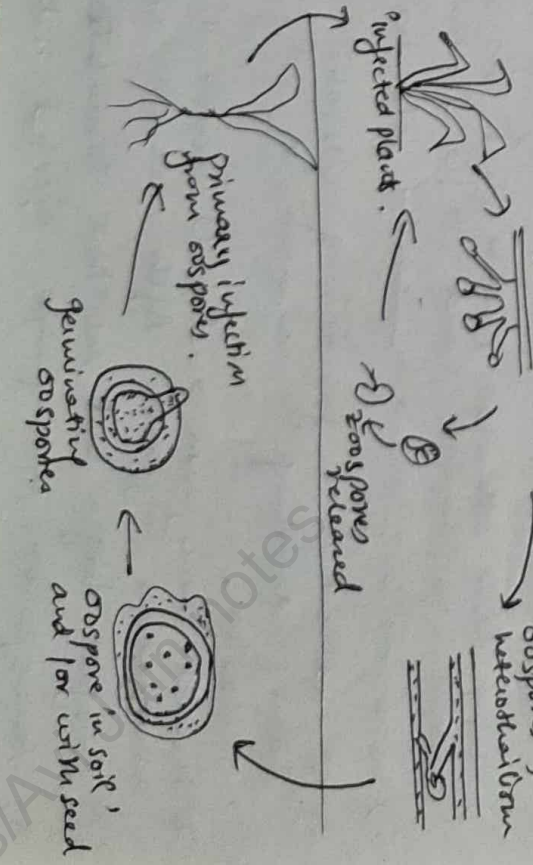
## Disease cycle

- Oospore → source of primary inoculum.
- Remain in soil & light underground parts of plant at seedling stage.
- Exact site of entry of oospore is unknown.
- Systemic infection within 6-11 days after sowing.
- Oospore transmitted through wind, water.
- Sporangia → secondary spread of disease by germination & production of oospores causes infection.
- Oospore germination requires:
  - 1) 10-25°C temperature
  - 2) low soil moisture
  - 3) requires available light soil.
  - 4) more conducive light soil.
- Acc to **Sethulla & Thiruvada** (1956) - at 15-20°C and 90% RH sporangia are formed.
- Acc to **Wetson** asexual stage of it is not known in India.

## Management

- 1) Raising of green ear heads.
- 2) Disease in softbore, SD adopt crop rotation about 4-5 yr.
- 3) Seed treatment - Tirazol 0.4%, or Apron SD 3.5 @ 6g/kg seed before sowing.
- 4) Spray Mancozeb @ 2g/ltr 21 days after sowing.
- 5) Hot water treatment - seeds at 55°C for 12 min & then dry in shade.
- 6) Resistant varieties - hybrid like RB-3.

- 1) Green ear phase appears on ear-head.
- 2) Chlorosis or yellowing of lower leaves, spread to upper leaves & whole plant.
- 3) Often lower half of leaf shows ringworm. White epiphytosis symptoms in leaves. This is called **leaf leaf symptom**.
- 4) Ear transformed into green leaf or leafy cob structure.





# DISEASES OF SORGHUM

## Disease

### 1) Smut

### Symptoms

### Etiology

### Disease cycle

### Management

(i) Grain smut | Kernel / Cervical | Short smut

1) not hive of grain formation in ear

2) grains transformed into elongated cylindrical structures of black spore masses

3) grains replaced by smut sor

Sphaerolotheca sorghi

• systemic fungus

• mycelium occupies the growing point

• seedling establishes to grow along the plant without producing any offspring until the symphom until the

1) pathogen is seed borne and seedling infection occur at time of germination

2) spores germinate & infect seed by penetrative through radicle to have systemic infection.

3) fungal hyphae replace young corn sor at

4) collect smutted ear heads in cloth bag and dip in boiling water.

1) Seed treatment freshly powdered sulphur @ 5g/kg seed.

2) crop rotation

3) use disease free seed

4) collect smutted ear heads in cloth bag and dip in boiling water.

(ii) Long smut | only few grains in panicle are attached. and curved transformed into long, cylindrical covered bodies.

1) smut sorus covered by whitish or yellow foamy thick membrane.

2) smut release brown spore masses on rupturing.

(iii) Head smut | occurs only at flowering.

1) entire floral structure transformed into smutted galls. (sorus)

CO. - Tolyposporium ehrenburgii

1) spores do not have dormancy period.

2) germination of spores at 15-36°C

3) sporidia are produced by soil borne spore become wind borne to cause systemic infection.

CO. Sphaerolotheca reiliana

1) under dry condition 21-28°C

2) pathogen is externally seed borne & soil borne.

CO. Sphaerolotheca cruenta

(iv) Loose smut affected plants detected before ear came out.

under favourable soil moisture & temp. seedling infection occurs b/w seed germination & emergence.

fungal growth follows the development of host without any visible symptoms.

flowering state of crops.

fungal hyphae rapidly grow to multiplex within the flower buds.

floral structure are converted & cells of hyphae are replaced the kernel water.

grain filled with black spores (smut spores) in infected ear heads.

Sporidia are formed after germination of smut spores at the tip of procygium & directly act infection hyphae

smut spores present in soil or adhered to seed surface also get germinated.

Disease cycle

germinated of sorghum seeds  
 smut spores get adhered to the healthy sorghum seeds during threshing & remain dormant thru next crop season

Smut soil with seeds reach the soil during sowing of seeds.

① Penetration in externally seed borne.

Smut soil are broken during threshing they remain dormant until next growing season.

② Infection primary infection

but b/w germination & emergence of seedling.

• mycelia arise from sporidia early & mycelia through radicle or node.

• No outward effect is produced while ear is formed.

• smut spores are formed which fill the ovary & convert into smut seeds.



## Disease

2) Head mould / grain mould / head blight

## Symptoms

- infected grains are covered with pink or black mold.
- such grains distasteful during threshing.
- If rain occur during flowering or ~~grain~~ grain filling stage, severe grain moulding occurs.

## etiology

CO. by fungi like -  
Fusarium, Alternaria, Aspergillus, Rhizopus, Helminthosporium, Phoma, Chaetomium, and Curvularia.

## fav. candida -

- wet weather following the flowering favours grain mould development.
- longer wet period greater mold development.

## Disease cycle

- spread through candida.
- fungi survive as parasite as well as saprophytes.

## Management

- 1) adjust the sowing time
- 2) seed treatment Thiram @ 0.3%.
- 3) Spray Mancozeb 0.25% during ear head emergence, a week later and during milky stage.

# DISEASES OF MAIZE

## Diseases

### Symptoms

1) Downy mildew / 1) chlorotic streaks on leaves.  
crazy top.

2) stunted & bushy appearance due to shortening of internodes.

3) white downy growth on lower surface of leaf.

4) Prostitution of auxiliary buds on stalk & cobs

### etiology

### Disease cycle

### Management

1) Deep ploughing

2) crop rotation

3) Raising

4) Seed treatment with Metaxoxyl @ 5g/kg

5) Spray metaxoxyl + Mancozeb @ 1kg on 20th day after sowing.

### CO.

Sorghum - Peronosclerospora sorghi  
downy mildew

Philippine dm. - P. philippinensis

Crazy top - Sclerophthora macrospora

### fav. condn.

low temp → 21-33°C

90% RH.

young plants are highly susceptible.

drizzling.

### CO. Helminthosporium maydis

### fav. condn.

germ with candida 8-27°C.

infection early in wet season.

1) seed borne fungus.  
2) also affect sorghum, wheat, barley, oats, sugar cane, black gram, green gram, mung bean, horse gram.

1) Seed treatment Thiram or Captan @ 4g/kg  
2) Spray Mancozeb 2kg or Dithian 1kg/ha

2) Leaf blight fungus crop at young stage affects crop yield.

• small yellowish round spots on leaves.

• spots increase and greyish brown in centre with dark brown margins.

• surface is covered with olive green velvety mass of candida & candidophores.

## Diseases

### Symptoms

- 3) Charcoal rot
- 1) wilting
  - 2) grey streak in stalk
  - 3) sclerotia on vascular bundles
  - 4) shredding of root bark.

### 4) Bacterial stalk rot

- basal internodes rot
- water soaked appearance
- mild sweet fermenting odor
- signs of wilting & topple down of affected plants
- ears hang down from plants

### 5) Mosaic

- chlorotic spots gradually turn into stripes covering entire leaf blade
- also on leaf sheath, stalks, husks
- rosetting

### 6) Brown spot

- water soaked lesions which are oval, later turn into light green & finally brown

### etiology

E.O. Rhizoctonia bataticola

- fav. cady
- high temp
- high soil moisture (drought)

Pathogen - fungus

• produces large no. of sclerotia which are round & black.

C.O. Erwinia dissolvens

- boreal insects causes initiation of disease
- soft borer, water entry through wounds & injury
- saprophyte on debris of infected material
- primary inoculum in next season

### Disease cycle

- primary source of infection is soil borne sclerotia.
- facultative parasite fungus living sapro phytrally on dead organic tissue.

### Management

- 1) crop rotation
- 2) irrigate at time of earhead emergence
- 3) seed treatment Captan @ 2g/kg
- 4) grow resistant varieties like Diva, Zeint.

E.O. Maize mosaic perkins

- viruses are flexuous
- ss RNA genome

1) Transmitted by leaf hoppers

2) Perkinsus maidis vector

C.O. Physoderma maydis