
MAIZE DISEASES

Presented

by

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Downy mildew - *Peronosclerospora sorghi* (*Sclerophthora macrospora*)



Crazy top

- The most characteristic symptom is the proliferation of leafy structures from the ears and/or tassels. In many cases, leafy protrusions occur in only the ears resulting in a mass of strap-like leaves protruding from the ear zone. Affected plants may also have profuse tiller development.



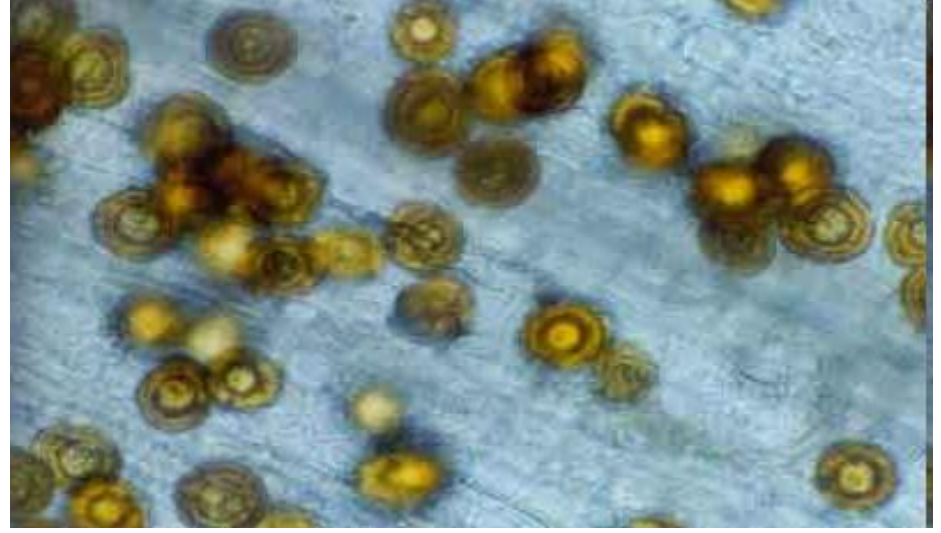


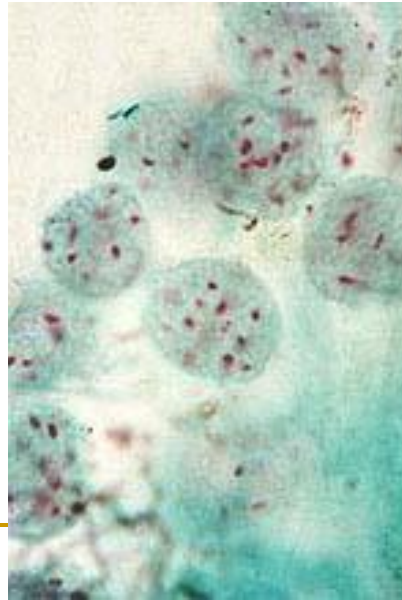
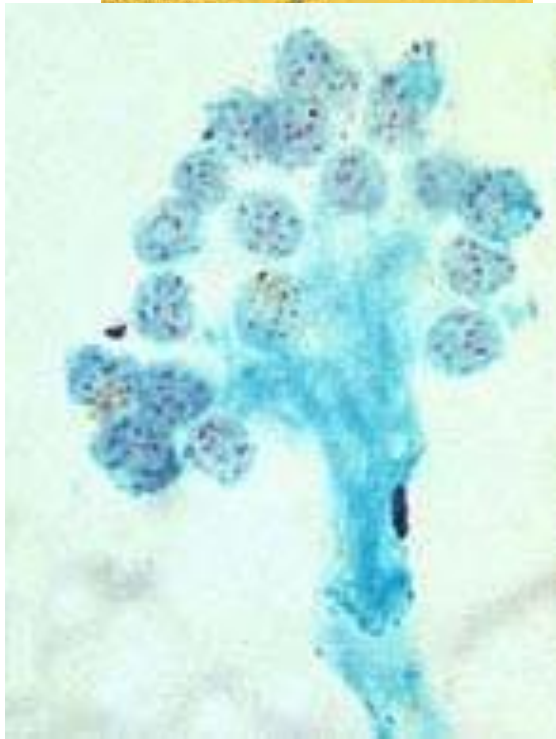
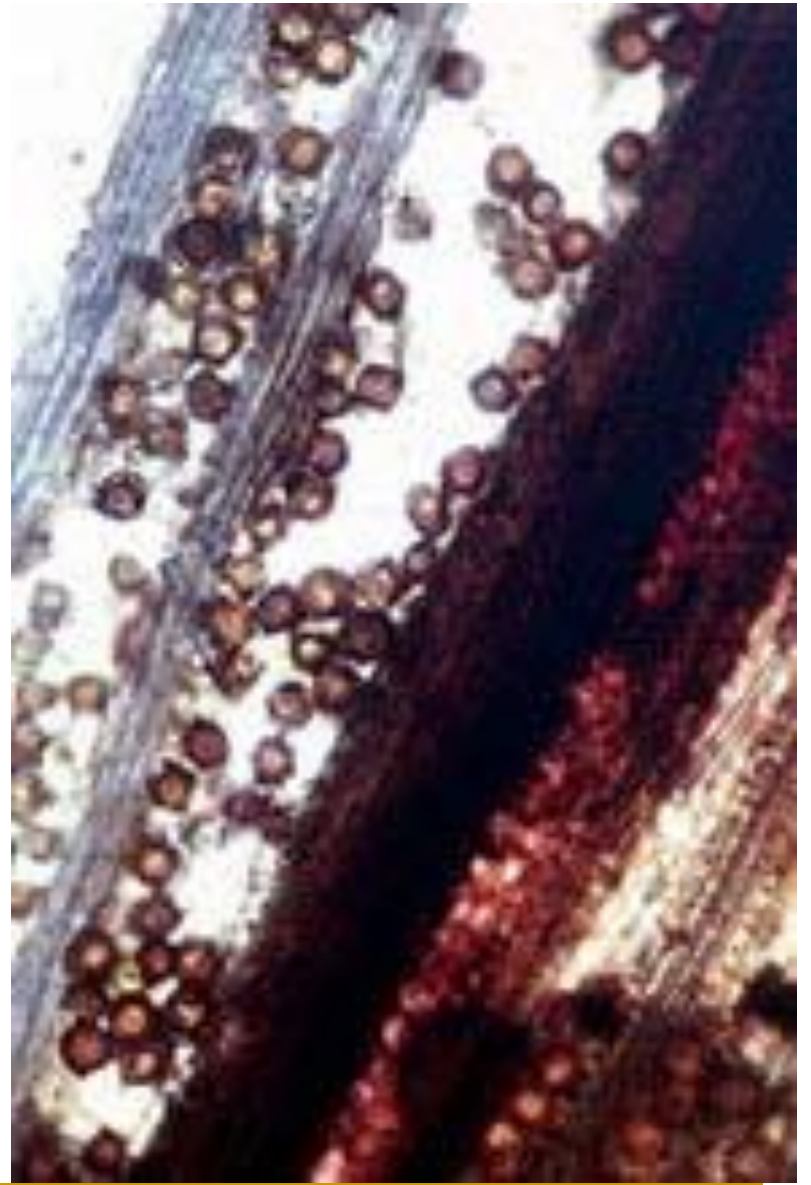
*Downy mildew
infected plant*



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Management

- Seed treatment with Metalaxyl fungicide metalaxyl @ 6.0 g/kg (or) Apron 35 WP @ 2.5 g/kg
 - Rogue out infected plants at early stage.
 - Spray with Metalaxyl 1g/lit or Metalaxyl + Mancozeb @ 2.5 g/lit.
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Philippine downy mildew -
Peronosclerospora philippinensis



Java downy mildew –
Peronosclerospora maydis

Sorghum Downy mildew - *Peronosclerospora sorghi*



Sugarcane Downy mildew –
Peronosclerospora sacchari



Brown stripe downy mildew- *Scleroptthora rayssiae* var. *zeae*

Symptoms

- Lesions start developing on lower leaves as narrow chlorosis or yellow stripes, 3-7 mm wide, with well defined margin and are delimited by the veins.
 - The stripes later become reddish to purple. Lateral development of lesions causes severe striping and blotching.
 - Seed development may be suppressed, plant may die prematurely if blotching occurs prior to flowering.
 - Sporangia on the leaves appear as a downy whitish to wooly growth on both surface of the lesions.
 - Floral or vegetative parts are not malformed, and the leaves do not shred.
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Management

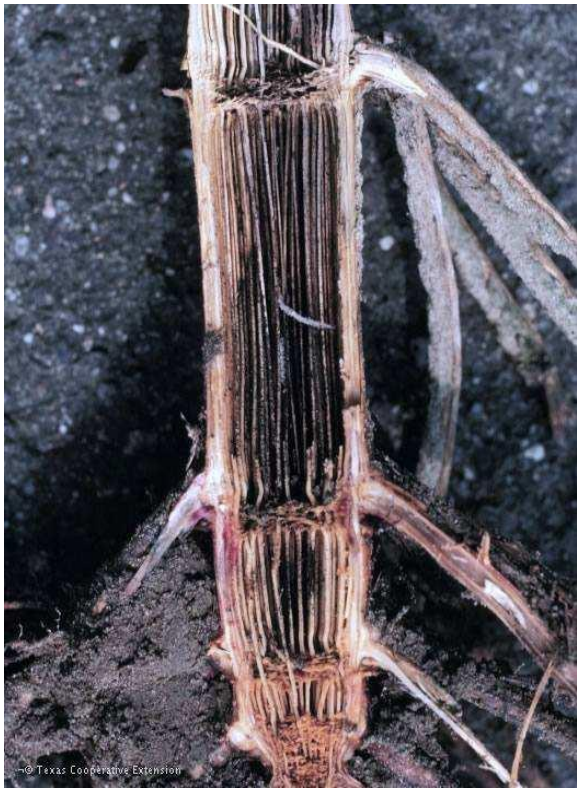
- **Resistant varieties** -Prabhat, Kohinoor, ICI-703, PAC-9401, PMZ-2, SEEDTEC-2331.
 - Seed treatment with Acylalanine fungicide metalaxyl @ 6.0 g/kg.
 - Rogue out infected plants at early stage.
 - Control - Apron 35 WP, @ 2.5 g/kg as seed treatment.
 - Spray with Metalaxyl 1g/lit or Metalaxyl + Mancozeb @ 2.5 g/lit.
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Charcoal stalk Rot - *Macrophomina*

phaseolina

Symptoms

- Disease appears 1-2 week after the flowering. The outside of the lower internode becomes straw coloured.
 - The pith becomes badly disintegrated.
 - The pathogen invades seedling roots. When plants approach maturity, the internal parts of stems show a black discolouration and shredding of the vascular bundles.
 - This occurs mainly in lower stalk internodes.
 - Careful examination of rind and vascular bundles of infected plants reveals small black sclerotia which can overwinter and infect next crop.
 - Fungus may infect kernels which cause them blacken completely.
-
- Disease is favoured by high soil temperature 30-42o C and low soil moisture.



Rhizoctonia* blight- *Rhizoctonia solani

- **Characteristic symptoms include concentric bands and rings on infected leaves and sheaths that are discolored, brown, tan or grey in color.**
- **Typically, disease develops on the first and second leaf sheath above the ground and eventually spreads to the ear causing ear rot.**
- **Ear rot is characterized by light brown, cottony mycelium on the ear and the presence of small, round, black sclerotia (compact mass of hyphae that can survive in unfavorable conditions).**
- **Ears dry prematurely and caking of the ear sheaths is common.**



Management

- Avoiding water stress at flowering time to reduce disease incidence,
 - Apply Trichoderma in furrows after mixing with FYM @ 2.5 kg/ha FYM/acre (mix 10 days before use in field).
-

Common Smut- *Ustilago maydis*

Symptoms:

- Galls develop on ears, leaves, stalk, or tassels
- Galls initially are covered with white to silvery tissue
- Interior of galls develop into a dark mass of dark spores

Over winters in crop debris or soil

- This pathogen is present where corn is grown around the world

Time of Occurrence:

- Can occur throughout the season





Smut of Sweet Corn





Common Rust- - *Puccinia sorghi*

Symptoms:

- Pustules are oval to circular, and red to dark brown
- Pustules are common on both leaf surfaces
- Rust spores (urediniospores) are cinnamon brown
- Leaves as well as sheaths can be infected, and under severe conditions leaf chlorosis or death may occur

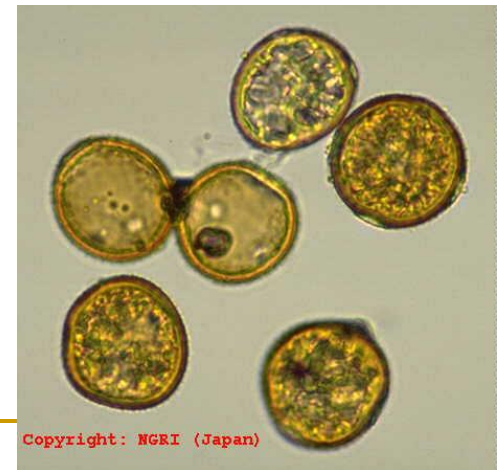
Pathogen Involved:

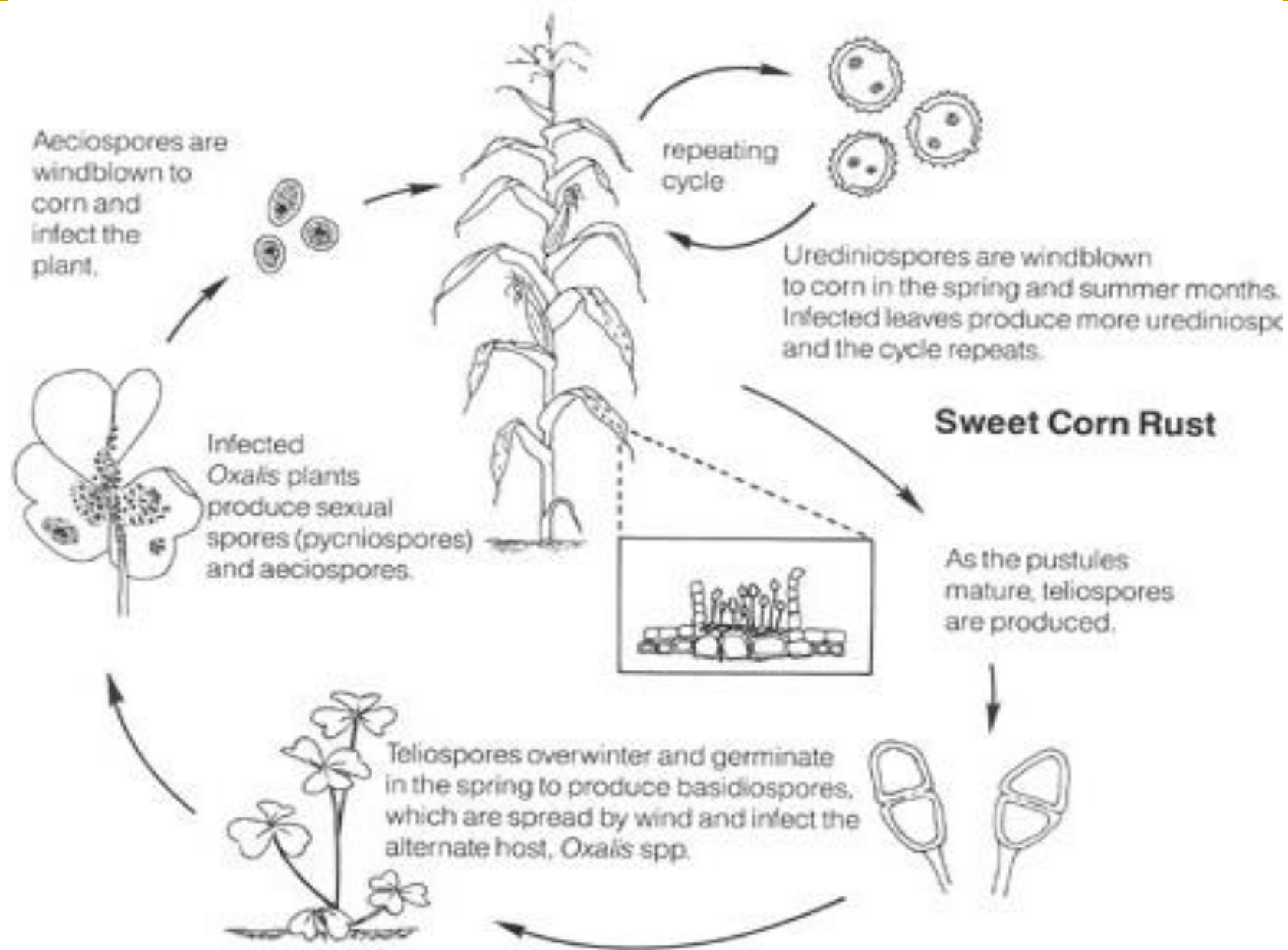
- Overwinters in the southern U.S. and Mexico (not in the corn belt)
 - Urediniospores serve as the repeating stage of this fungus and are blown north to the corn belt in the early summer
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Managment

- Spray Mancozeb – 1.25 kg/ha



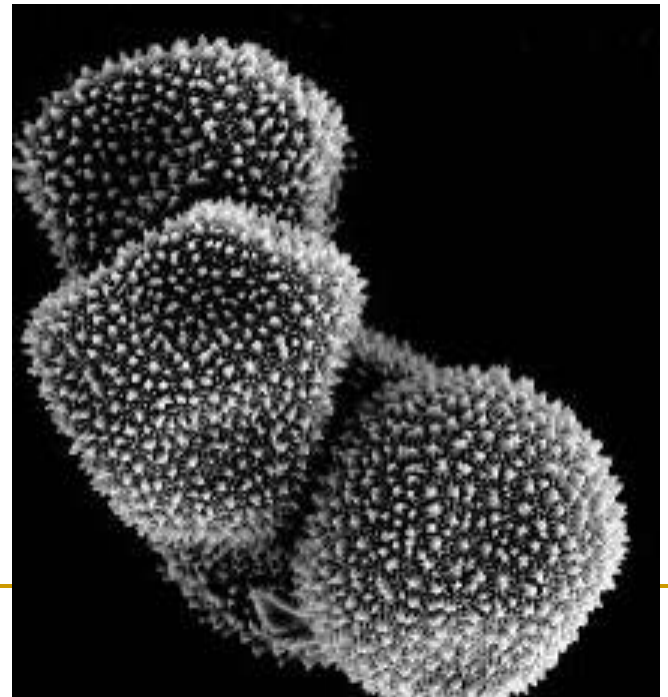
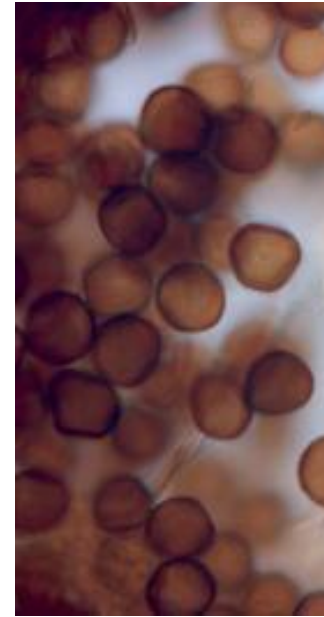


Head Smut- *Sphacelotheca reiliana*

Symptoms

- Ears and tassels may be replaced with smut sori filled with teliospores.
- Infected plants may develop bizarre symptoms on either the ear or the tassel, including the production of wire-like extensions of the vascular bundles in the tassel or finger-like proliferations in the ear .
- Ears of infected plants may be recognized by their teardrop-shape and lack of silks where the husks are filled with teliospores





Management

- Crop rotation with pulses
- Treat the seeds with captan or thiram at 4g/kg
- Planting date may also be altered in some areas, planting earlier to avoid the optimal temperatures for teliospores germination.



Maydis leaf blight (MLB) - *Bipolaris maydis* or *Cochliobolus heterostrophus*

Symptoms

- Young lesions are small and diamond shaped.
- As they mature, they elongate. Lesions may coalesce, producing a complete “burning” of large areas of the leaves.
- They vary in size and shape among inbreds and hybrids with different genetic background.
- Race ‘O’ produced tan, elongated (2-6x 3-22 mm) lesion between the veins with limited margins, with buff to brown borders, usually attacks only leaves.





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Management

- Spray with Mancozeb @ 2 g/ lit of water.
 - Resistant varieties – Deccan, VL 42, Prabhat, KH-5901, PRO-324, PRO-339, ICI-701, F- 7013, F-7012, PEMH 1, PEMH 2, PEMH 3, Paras, Sartaj, Deccan 109.
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Turcicum Leaf Blight (TLB) -

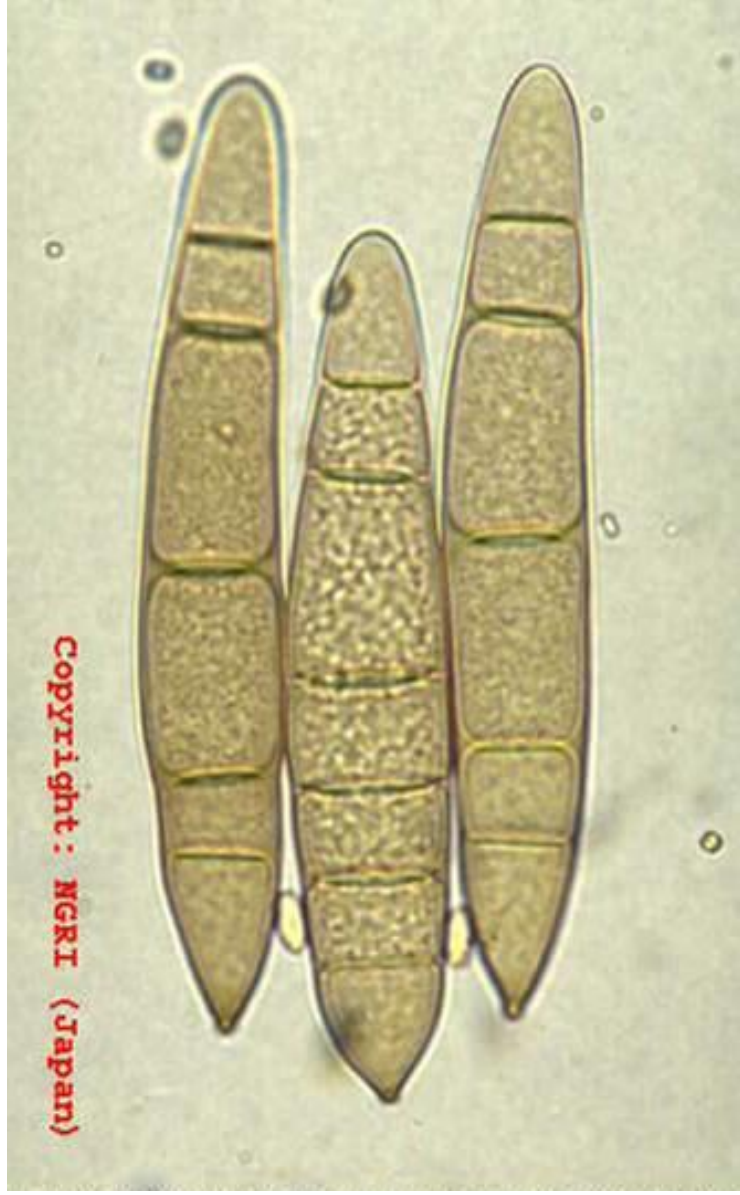
Exserohilum turcicum



Significant Loss of Leaf Area Due to Northern Corn Leaf Blight







- ▶ 1: Lesions produced by *Exserohilum turcicum* on sorghum (A) and maize (B).
- ▶ 2: Sorghum trial conducted during the 2014/2015 season at Potchefstroom to establish yield loss impact of *Exserohilum* leaf blight on sorghum.
- ▶ 3: Degree of *Exserohilum turcicum* disease severity achieved during the 2014/2015 season with a sorghum trial planted at Potchefstroom.



Symptoms

- It causes significant economic damage when infection takes place at silking stage and conditions are optimum. In early stages slightly oval, water soaked, small spots produced on leaves. These grow into elongated, spindle-shaped necrotic lesions
 - They appear first on the lower leaves and continue increasing in size and number as plant develops, until the complete ‘burning’ of foliage is conspicuous.
 - These spots are long, elliptical, grayish-green or tan lesions ranging from 2.5 to 15 cm in length
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Management

- Spray with Mancozeb @ 2.0 g/lit.
- Resistant varieties – Sartaj, Deccan 105, Trishulata, Deccan 109, EH-40146, JH-1267



Pythium stalk rot - *Pythium aphanidermatum*

Symptoms

- Usually the basal internodes become soft, dark brown water soaked, causing the plants lodge.
- Damaged internodes commonly twist before the plants lodge. Diseased plants can remain alive until all vascular bundles become affected.
- Isolations in culture media are necessary to differentiate *Pythium* from *Erwinia* stalk rots



Management

- Planting time between 10 & 20 July in Northern India.
 - Maintain plant population around 50,000/ha.
 - Good field drainage.
 - Removal of previous crop debris.
 - Soil drench with Captan at basal internode (5-7week growth stage)@ 1g/lit of water.
 - Resistant varieties – Ganga, Safed 2
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Fusarium stalk rot- *Fusarium moniliforme*

Symptoms

- Affected plant wilts, leaves change from light to dull green, and the lower stalks become straw coloured.
- Reddish discoloration occurs inside the infected stalk.
- The internal pith tissue disintegrates, leaving only the vascular bundles.
- Fungus enters through roots and grow up in to lower stem.
- If infection occurs just after flowering, husks appear bleached and straw coloured





Post flowering stalk rots (PFSR) most prevalent in the region

Fusarium graminearum stalk rot (*Gibberella*)

Fusarium stalk rot (*F. verticillioides* syn *F. moniliforme*)

Stenocarpella maydis stalk rot (syn. *Diplodia*)

Macrophomina stalk rot (*M. phaseolina*)

Late wilt or *Cephalosporium* stalk rot (*C. maydis*)

Both *Macrophomina* stalk rot and *Fusarium* stalk rot can be favored by high temperatures



Fusarium graminearum ear rot



Favored by cooler temperatures



Stenocarpella maydis ear rot



Aspergillus flavus ear rot

Favored by warmer temperatures



Fusarium verticillioides ear rot

Important not only for direct losses, but as well for the mycotoxins they produce including aflatoxins, fumonisins, deoxynivalenol, zearalenone, and diplosporin that make the grain unfit and potentially lethal for human or animal consumption

Major ear rots in the Asian region

Management

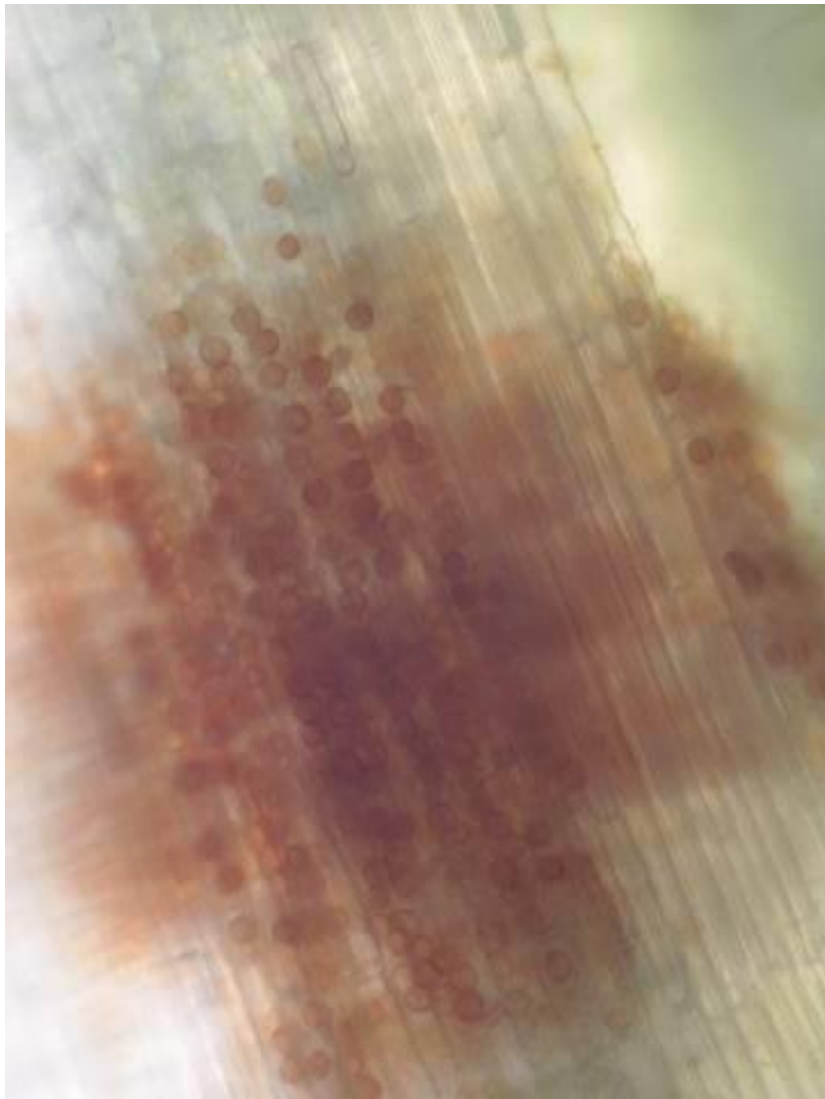
- Application of potassic fertilizers reduces infection.
 - Seed from infected areas should not be planted.
 - Rotation with other crops.
 - Resistant varieties – Ranjit and Ganga 5
-

Brown spot - *Physoderma maydis*

Symptoms

- The first noticeable symptoms develop on leaf blades and consists of small chlorotic spots, arranged as alternate bands of diseased and healthy tissue.
- Spots on the mid-ribs are circular and dark brown, while lesions on the laminae continue as chlorotic spots. Nodes and internodes also show brown lesions.
- In severe infections, these may coalesce and induce stalk rotting and lodging.







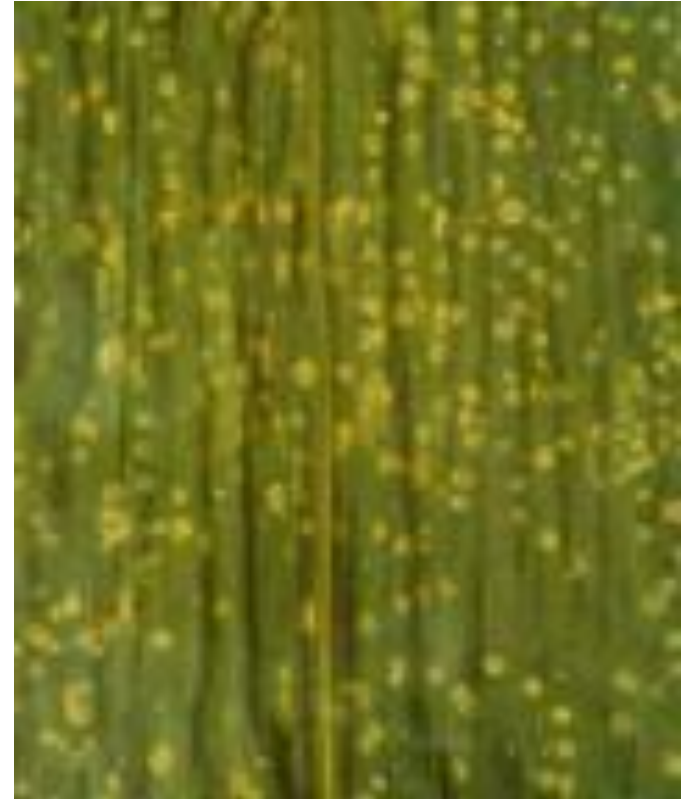
Management

- Planting corn early allow to escape infection.
 - Removing of *Saccharum spontaneoum* grass growing around the crop, can minimise the disease.
 - Systemic fungicides mainly based on acylalamines such as, metalaxyl .
 - Resistant varieties – Ganga 11,Deccan, Deccan 103,Composite Suwan1, F-9572 A, JKMH-178-4, FH-3113
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Curvularia Leaf Spot- *Curvularia pallescens*, *Curvularia lunata*

Symptoms

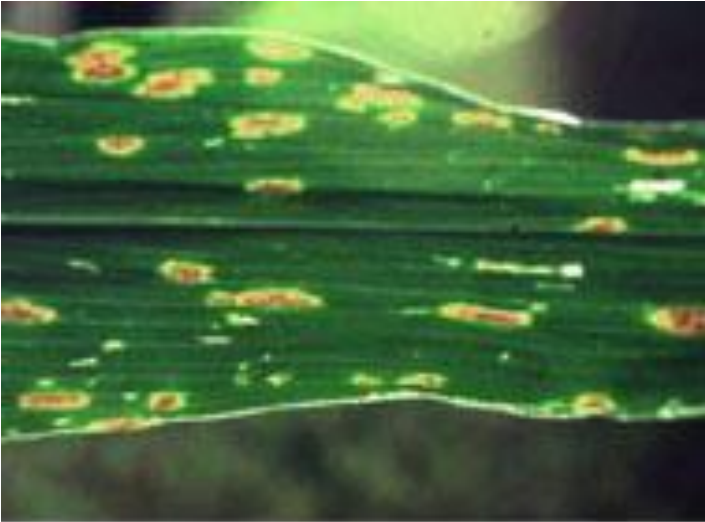
- The disease appears in the form of flecking which later develops into larger lesions.
- The lesions in general are round to oval, separate or coalescent, 1-6 mm in diameter.
- The centre of each lesion is straw coloured to light brown, which is surrounded by a dark brown margin.



Management

- Seed treatment with Thiram and Captan @ 2g/kg reduce seed infection
 - Two applications of Captafol @ 2g/lit of water
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Gray Leaf Spot- *Cercospora zeae-maydis*



Symptoms

- Initial lesions appear as greenish black water soaked circular areas with chlorotic halos, expanding into oval and then the diagnostic parallel sided rectangular brownish gray lesions.

-
- **Conditions:** Infection is favored by extended warm, wet, humid weather.
 - **Inoculum Survival:** Infected crop residue (leaves and leaf sheaths).
 - **Inoculum Dispersal:** Airborne spores.
 - **Management:** Select hybrids with resistance (tolerance based on risk), two year crop rotation, cleanly plow under infected residue.
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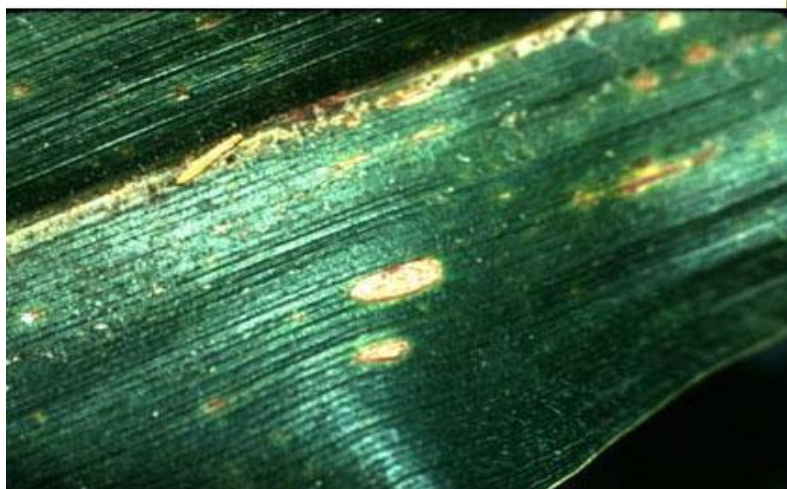
Zonate leaf spot – *Gloeocercospora sorghi*



Gray leaf spot – *Cercospora zea-maydis*

Cercospora sorghi* var. *maydis

Anthracnose Leaf Blight - *Colletotrichum* *graminicola*



Symptoms:

- Small, oval to elongated water-soaked lesions enlarge to become brown, spindle shaped spots with yellow to reddish-brown borders.
- Lesions may coalesce and blight entire leaves.
- Older lesions will turn gray in the center with small black specks (acervuli with sterile black hairs).
- Leaf blight may be followed by top kill and stalk rot. Leaf blight rarely causes large yield losses. Stalk rot phase is most important (

Anthracnose – *Colletotrichum graminicola*
(**Teleomorph:** *Glomerella graminicola*)

Symptoms

- **Irregular oval to elongated lesions with yellow – reddish brown margin appear on leaves**
- **Destructive phase is the stalk rot phase**





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Anthracnose leaf blight on lower leaves early in season.



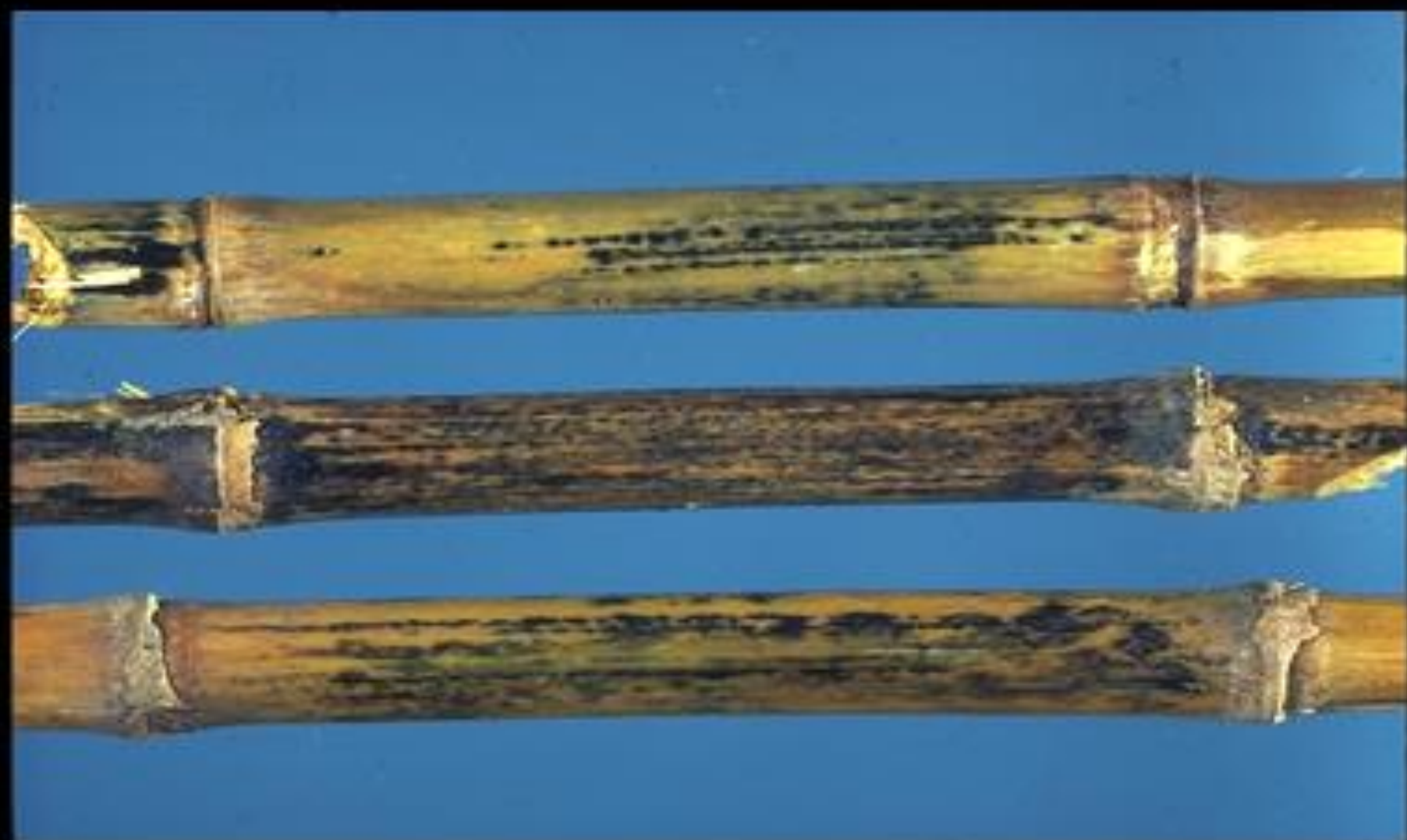
© Pat Lipps

Anthracnose leaf blight.



**Anthracnose
stalk rot**





Anthracnose stalk rot.

-
- **Conditions:** Favored by cool to warm, wet, humid weather, continuous corn with reduced tillage.
 - **Inoculum Survival:** Infected crop residue (leaves, leaf sheaths and stalks), seed (endosperm).
 - **Inoculum Dispersal:** Airborne spores.
 - **Management:** Resistant hybrids, rotate corn with nongrass crops. Cleanly plow under infected residue.
-



polysora rust
(*Puccinia polysora*)



maydis leaf blight
(*Bipolaris maydis*)

Primary tropical foliar diseases favored by warmer temperatures

Primary subtropical and temperate foliar diseases favored by cooler temperatures



Common rust
(*Puccinia sorghi*)



Gray leaf spot
(*Cercospora zea-maydis*)



Turcicum leaf blight
(*Exserohilum turcicum*)



Banded leaf and sheath blight
(*Rhizoctonia solani* AG1-IA) predominant

Primarily tropical and subtropical disease favored by warm humid conditions

Ergot /Sugary disease/ horse's tooth - *Claviceps gigantea*

- Infected kernels grow into large fungal structures known as sclerotia alongside normal healthy kernels.
- In the early stages of infection, sclerotia are pale colored, soft and slimy, finally hardening toward harvest time.



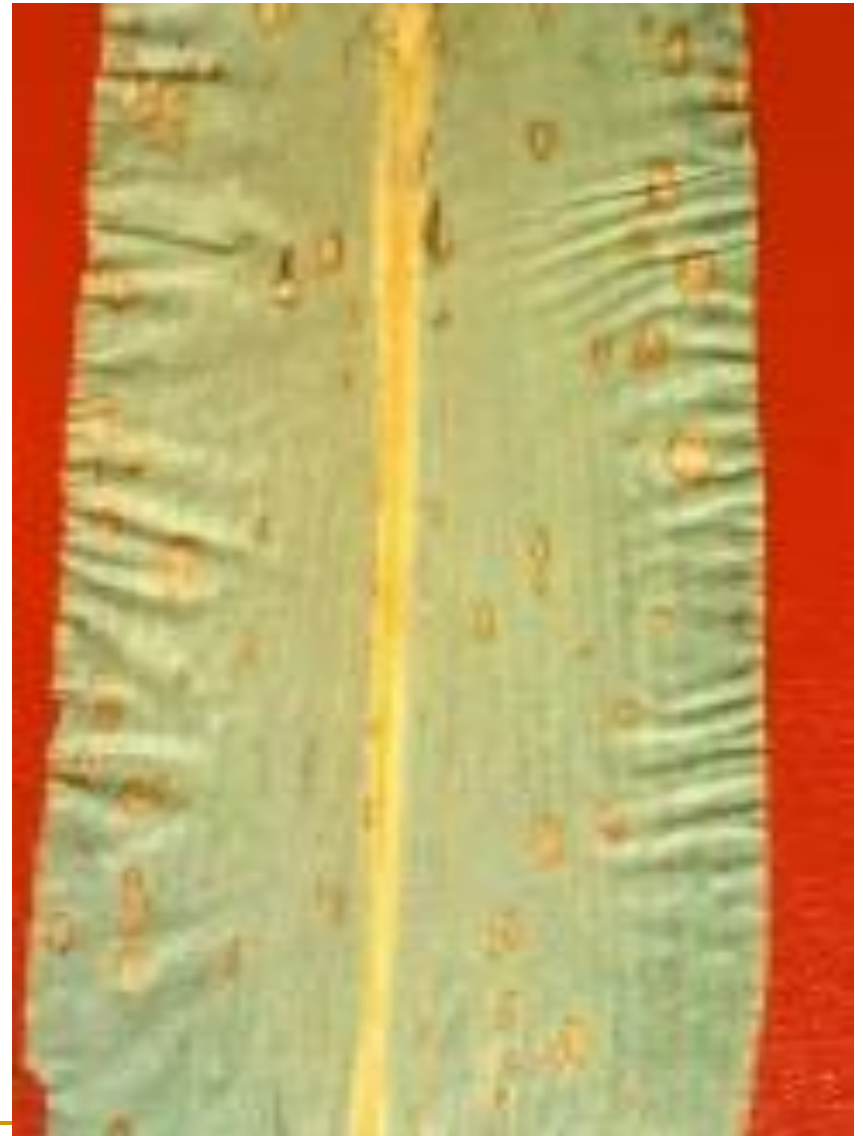


Leaf spot – *Bipolaris zeicola* (Syn. *Helminthosporium carbonum*)

Symptoms

Elongate, oval, zonate,
brownish lesions
appear mostly on lower
leaves

Lesions also appear on
ear, which rot and turn
black



False head smut – *Ustilaginoidea virens*

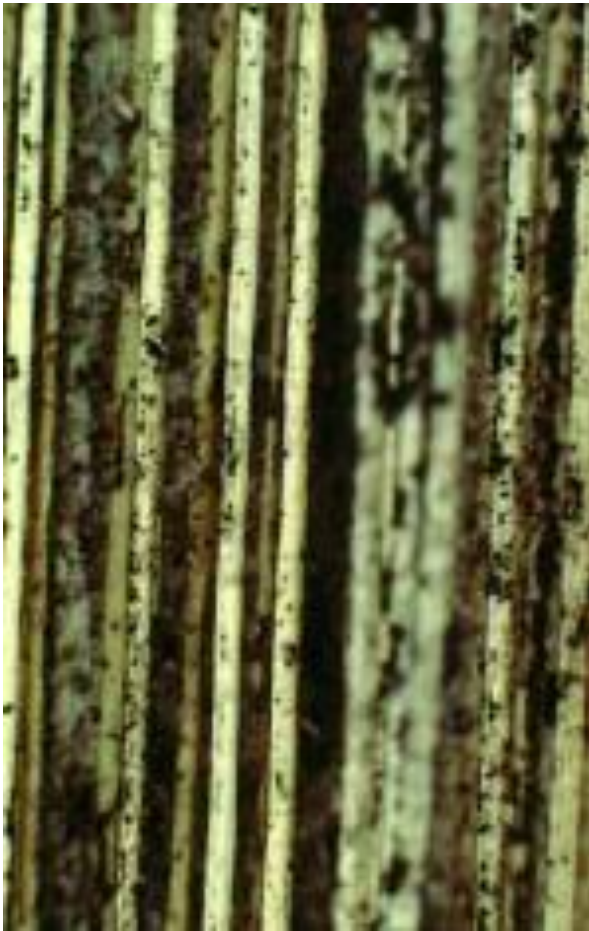


Charcoal stalk rot – *Macrophomina phaseolina*

Wilting and gradual drying of plants

Stalks become weak and sclerotia occur on the rind

Black discolouration of internal parts of stem and shredding of vascular bundles



Small, black, sclerotial bodies found in rind and vascular tissues

Disease occurs just before the emergence of the earhead

Pathogen

Fungus produces large number of round and black sclerotia

Pycnidia appear on the stalks.

Pycnidiospores are colourless, oval and single celled and borne in black flask shaped pycnidia

Sclerotia are black and globular to irregular in shape

Mode of spread and survival

PS – Sclerotia in infected crop debris

SS – Wind-borne pycnidiospores

Fav. Condition: Post flowering and grain filling stage

Warm temp 36 – 40°C and low moisture

Management

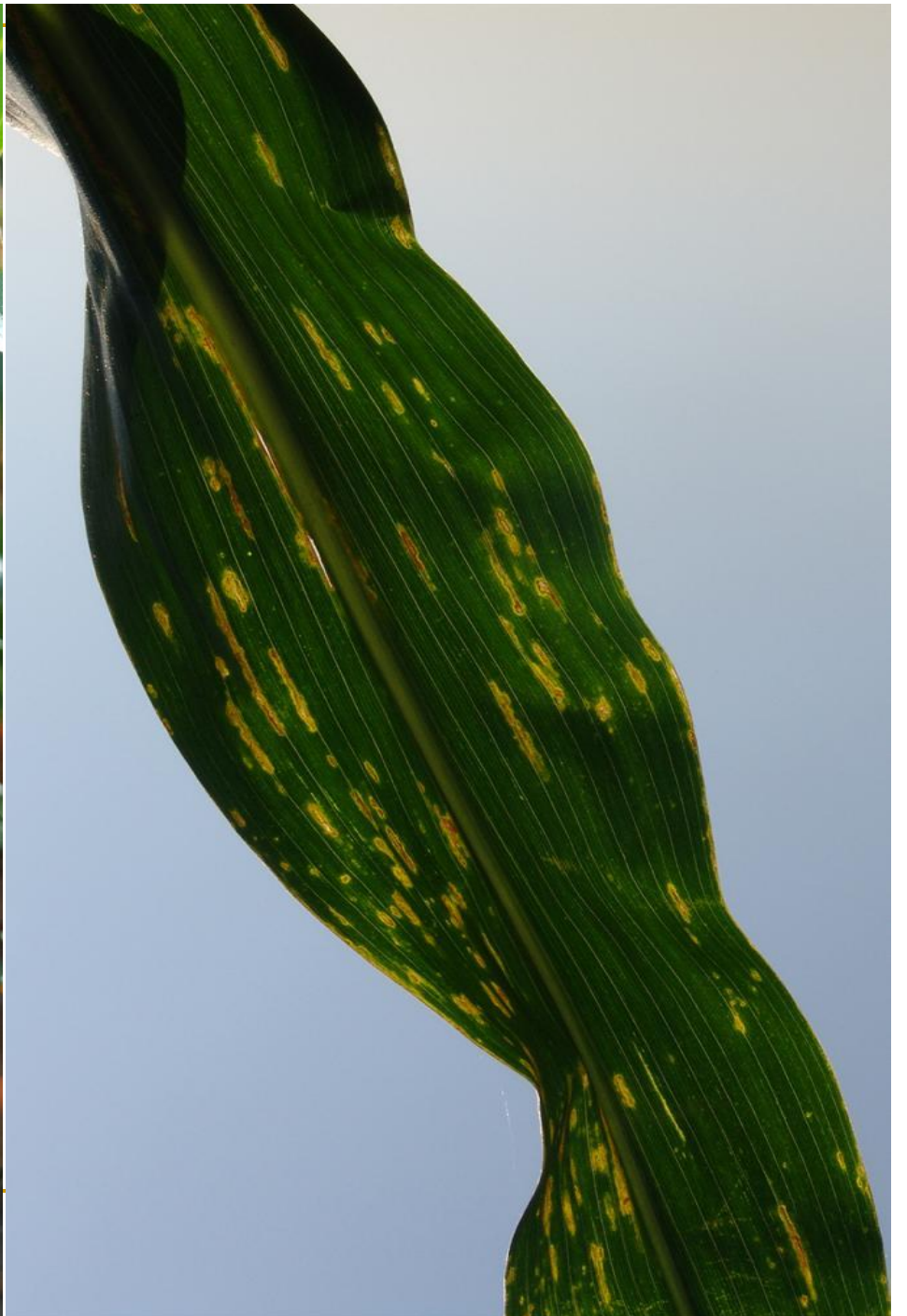
Irrigation, Crop rotation and seed treatment

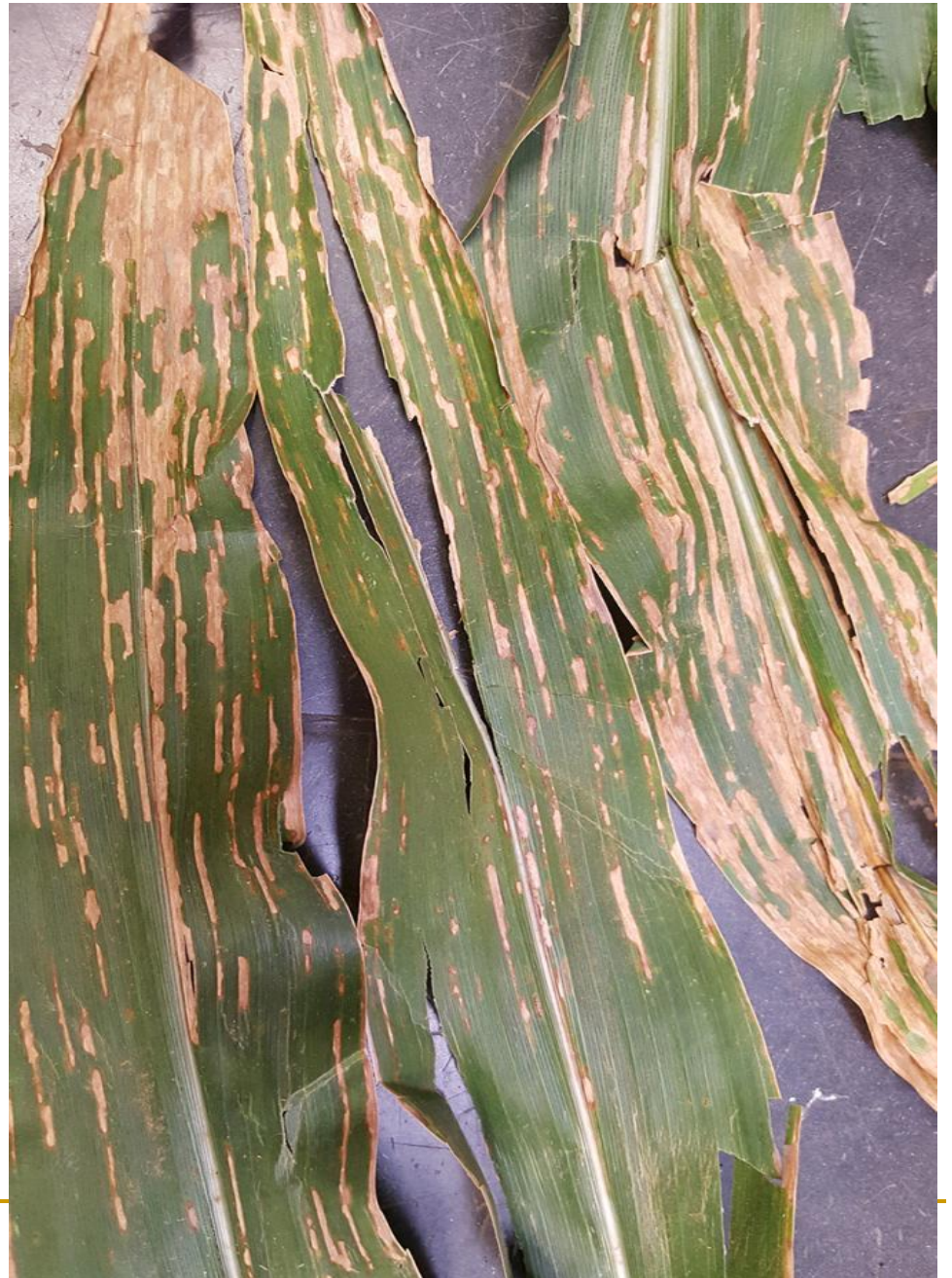
**Bacterial leaf streak, caused
by *Xanthomonas vasicola* pv. *vasculorum* (syn *X. campestris* pv. *zeae*)**

- **Narrow stripes between leaf veins may initially look like the common fungal disease, gray leaf spot.**
 - **Lesions can be brown, orange, and/or yellow and are often yellow when backlit.**
 - **Lesions usually have slightly wavy edges in contrast to the smooth, linear lesion margins of gray leaf spot.**
-

Bacterial leaf streak











Gray leaf spot



Bacterial leaf streak

Bacterial stalk rot-*Erwinia chrysanthemi* pv *zeae*

Symptoms

- The stalk near the ground become water-soaked with brownish discolouration and are easily breakable.
- The rotting tissues emit a putrid smell.
- Infected plants show dark colour and water soaking at the base of the stalk. Plants die shortly after tasseling.
- The bacterial decomposition produces an unpleasant odor.



Management

- Bleaching powder containing 33% chlorine @ 10 kg/ha as soil drench at pre-flowering stage
 - Planting crop on ridges. Avoid water logging and proper drainage
-

Maize dwarf mosaic

Symptoms : often begin as chlorotic spots and streaks on green, young leaves, which later develop into a mottle or a mosaic pattern

- Viral strain, corn genotype, and stage of corn development at the time of infection will affect the type of symptoms
- Upper internodes of corn may be shortened, and excessive tillering may occur
- Ear formation and development may slow, which may cause grain yield loss
- Hybrids infected early in their growth stage may be stunted



(Aphids)



- **Many strains of MDMV identified**
 - **Strain A: Source = Johnsongrass**
 - **Strain B: Johnsongrass is not host**
- **Transmission: Aphid species**
 - **Corn leaf aphid is primary vector**



Maize dwarf mosaic (a potyvirus)

- This pathogen consists of 4 strains: C, D, E, and F
- Aphids (= 15 species) can transmit MDMV non-persistently
- Can be seed transmitted at a low frequency or mechanically transmitted by leaf rubbing, etc.
- Infects Johnson grass and sorghum



Time of Occurrence:

- Symptoms appear six weeks after aphids feed and transmit this virus

Conditions Favoring Disease:

- Average to warm temperatures
 - Nearby Johnson grass infected with MDMV may increase disease
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Maize streak virus- **Maize streak geminivirus (MSV).**

- The disease was first reported in east Africa in the early 1900s and remains a major constraint to maize production in much of sub-Saharan Africa.
- MSV is transmitted by several species of *Cicadulina* leafhoppers.



Symptoms

- Disease symptoms first become apparent about a week following infection.
 - Small (0.1 to 2 mm in diameter), chlorotic, circular spots arise on the basal sections of young leaves that emerge after infection.
 - Spots contrast sharply with surrounding healthy green leaf tissue.
 - Numbers of spots increase with plant growth and can coalesce. In susceptible varieties, spots enlarge parallel to leaf veins, forming distinctive elongated, chlorotic streaks distributed evenly over the leaf surface.
 - Infection with MSV commonly results in crop stunting and barren plants.
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Host resistance

- Cultivation of resistant varieties offer the most practical and cost-effective means of disease management.
- Resistant varieties are widely available.
- Resistant varieties have been developed by IITA and CIMMYT and adapted for a wide range of growing conditions in Africa.

Vector management

- Management of vector populations through insecticide use can reduce rates of disease transmission.
- However, insecticide application is often uneconomical due to the uncertainty regarding disease outbreaks.

Cultural control

- As MSV is known to infect a wide range of graminaceous species, there are few cultural practices that can reduce disease severity.
-