

# DISEASES OF COTTON CROP

Session-7

M.S.Swaminathan School of Agriculture,CUTM

FIGURE 2



# MAJOR DISEASES OF COTTON

## FUNGAL DISEASES

**FUSARIUM WILT**  
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*Fusarium oxysporum f.sp. vasinfectum*

**VERTICILLIUM WILT**

*Verticillium dahliae*

**ANTHRACNOSE**

*Colletotrichum capsici or C.gossypii*

**ALTERNARIA LEAF SPOT**

*Alternaria macrospora*

## BACTERIAL DISEASES

**BACTERIAL BLIGHT OR ANGULAR LEAF SPOT OR BLACK ARM**

*Xanthomonas campestris pv. malvacearum*



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# FUSARIUM WILT

- In India the disease was first reported from nagpur in 1908.

- The disease occur severly in heavy soil and less in loamy soil .

## SYMPTOMS

- The disease affects the crop at all stages.

- The earliest symptoms appear on the seedlings in the **cotyledons which turn yellow and then brown.**

- **The base of petiole shows brown ring**, followed by wilting and drying of the seedlings.

- In young and grown up plants, the first symptom is **yellowing of edges of leaves and area around the veins, i.e. discolouration** starts from the margin and spreads towards the midrib.

- The leaves loose their turgidity, gradually turn brown, droop and finally drop off.

- Symptoms start from the older leaves at the base, followed by younger ones towards the top, finally involving the branches and the whole plant.

- The defoliation or wilting may be complete leaving the stem alone standing in the field.

- Sometimes partial wilting occurs; where in only one portion of the plant is affected, the other remaining free.

- The taproot is usually stunted with less abundant laterals.

- **Browning or blackening of vascular tissues is the other important symptom**, black streaks or stripes may be seen extending upwards to the branches and downwards to lateral roots.

- In severe cases, discolouration may extend throughout the plant starting from roots extending to stem, leaves and even bolls.



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# SYMPTOM IN INFECTED PLANT



**Marginal chlorosis & necrosis**



**Browning of vascular bundles**



**yellowing and dropping of leaves in affected leaf**



## CAUSAL ORGANISM: *Fusarium oxysporum f.sp. Vasinfectum*

[Subdivision-Deuteromycotina,order-Moniliales,Family-Tuberculariaceae]

- The fungus is present in both **inter and intra-cellularly** in the host tissue.
- The mycelium plugs the xylem vessel partially or completely.
- The fungus produces three types of spores.
- *Emphiala* conidia are 1 to 5 **septate, hyaline, thin** walled, falcate with tapering ends.
- The **microconidia** are **hyaline, thin walled, spherical or** elliptical, single or two celled.
- **Chlamydospores** are **dark coloured and thick walled.**
- The fungus also produces a vivotoxin, **Fusaric acid which is partially responsible for wilting** of the plants.

### DISEASE CYCLE

- The fungus can survive in soil as saprophyte for many years and **chlamydospores act as** resting spores.
- The pathogen is both externally and internally seed-borne.
- The primary infection is mainly from dormant hyphae and chlamydospores in the soil.
- The secondary spread is through **conidia and chlamydospores which are disseminated by irrigation** water.

### FAVOURABLE CONDITIONS

- Soil temperature of **20-30°C**.
- **Hot and dry periods followed by rains.**
- **Heavy black soils** with an alkaline reaction.
- Increased doses of nitrogen and phosphatic fertilizers, soil amendment with manganese and wounds caused by nematode (*Meloidogyne incognita*) and grubs of Ashweevil (*Mylocerus pustulatus*).



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# PATHOGEN

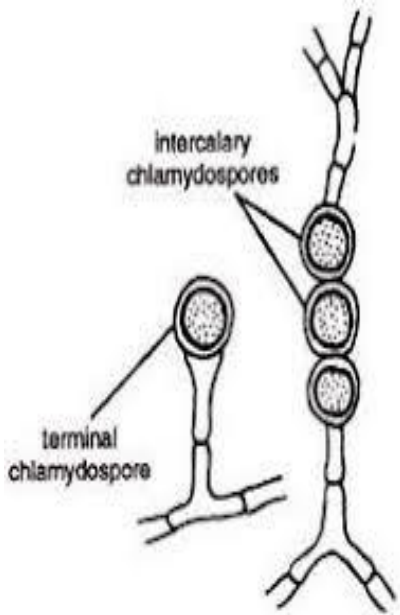
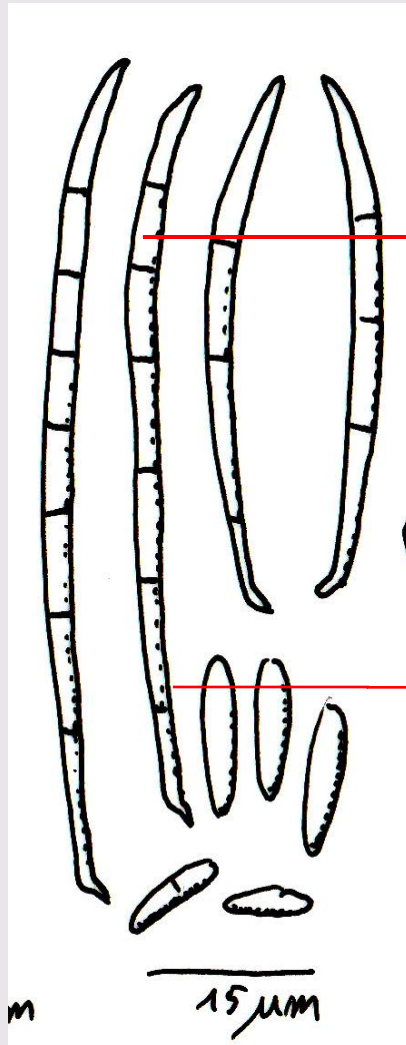


Fig. 4. *Fusarium* : Chlamydospores



**MACROCONIDI  
A**

**MICROCONIDIA**



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# MANAGEMENT

- Treat the acid-delinted seeds with Carboxin or Chlorothalonil at 4 g/kg or Carbendazim@2g/kg seed.
- Remove and burn the infected plant debris in the soil after deep summer ploughing.
- Apply increased doses of potash with a balanced dose of nitrogenous and phosphatic fertilizers.
- Multiply *Trichoderma viride* (2kg) in 50 kg of Farm yard manure for 15 days and then apply to the soil.
- Apply heavy doses of farm yard manure or other organic manures at 10 t/ha.
- Follow mixed cropping with non-host plants to lower the soil temperature below 200C by providing shade.
- Soil amendment with zinc.
- Grow disease resistant varieties of *G. hirsutum* and *G. barbadense* like Varalakshmi, Vijaya, Pratap, Jayadhar, Jarila, Jyothi, G 22 and Verum.



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# VERTICILLIUM WILT

## ECONOMIC IMPORTANCE

- The disease is a major disease in cotton in **USA and USSR and was first reported in India** during 1968 on *hirsutum* cottons in *Coimbatore, Tamil Nadu*.
- *The disease usually appears* in November and December when the crop is in **squares and bolls, about three months** after sowing.

## SYMPTOMS

- The symptoms are seen when the crop is in squares and bolls.
- Plants infected at early stages are severely stunted.
- The first symptoms can be seen as distinct **mottling of leaves** with pale yellowish irregular areas at the margins and between the principal veins.
- The yellowish areas become pale, more whitish and extensively necrotic.
- The **necrosis of the** leaves spreads from lower to upper leaves and there is heavy defoliation.
- The affected leaves fall off leaving the branches barren.
- Infected stem and roots, when split open, show a **pinkish to pinkish brown discolouration of the woody tissue which may be** continuous or interrupted.
- Pinkish streaks alternating with healthy tissue (**Tiger stripe**) are seen on removing the bark of the roots, stem and petiole.
- The affected plants may bear a few smaller bolls with immature lint.





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# VERTICILLIUM WILT SYMPTOM

## Verticillium Wilt





**CAUSAL ORGANISM:** *Verticillium dahliae*

[Subdivision-Deuteromycotina,order-Moniliales,Family-Moniliaceae]

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- The fungus produces hyaline, septate mycelium and two types of spores.
- The conidia are single celled, hyaline, spherical to oval, borne singly on verticillate conidiophores.
- The micro sclerotia are globose to oblong, measuring 48-120 X 26-45um.

## DISEASE CYCLE

- The fungus also infects the other hosts like **brinjal, chilli, tobacco and bhendi.**
- **The** fungus can survive in the infected plant debris and in soils as **microsclerotia upto 14** years.
- The seeds also carry the microsclerotia and conidia in the fuzz.
- The primary spread is through the micro sclerotia or conidia in the soil.
- The secondary spread is through the contact of diseased roots to healthy ones and through dissemination of infected plant parts through irrigation water and other implements.

## FAVOURABLE CONDITIONS

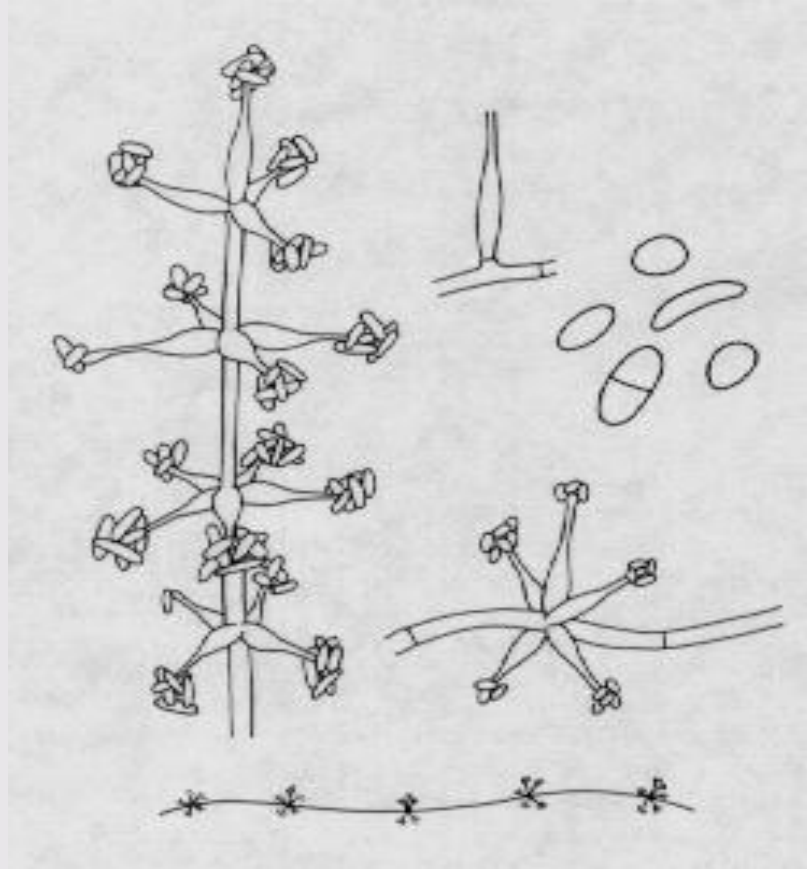
- Low temperature of **15-200C, low lying and ill-drained soils, heavy soils with alkaline** reaction and heavy doses of nitrogenous fertilizers favours the disease.



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# PATHOGEN



**CONIDIOPHORE & CONIDIA**



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# MANAGEMENT

Treat the delinted seeds with Carboxin@4g/kg or Carbendazim at 2 g/kg.

- Remove and destroy the infected plant debris after deep ploughing in summer months.
- Apply heavy doses of farm yard manure or compost at 10t/ha.
- Follow crop rotation by growing **paddy or Lucerne or chrysanthemum for 2-3 years.**
- Spot drench with 0.05 per cent Benomyl or Carbendazim.
- Grow disease resistant varieties like Sujatha, Suvin and CBS 156.



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# ANTHRACNOSE

## SYMPTOMS

- The fungus infects the seedlings and produces small reddish circular spots on the cotyledons and primary leaves.
- The lesions develop on the collar region, stem may be girdled, causing seedling to wilt and die.
- In mature plants, the fungus attacks the stem, leading to stem splitting and shredding of bark.
- The most common symptom is boll spotting.
- Small water soaked, circular, reddish brown depressed spots appear on the bolls.
- The lint is stained to yellow or brown, becomes a solid brittle mass of fiber.
- The infected bolls cease to grow and burst and dry up prematurely.



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# ANTHRACNOSE SYMPTOM IN BOLL





**PATHOGEN** *Colletotrichum capsici* or *C.gossypii*

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The pathogen forms large number of **acervuli on the infected parts.**

The **conidiophores** are slightly curved, short, and club shaped.

- The conidia are hyaline and **falcate, borne single** on the conidiophores.
- Numerous black coloured and thick walled **setae are also produced** in acervulus.

#### **DISEASE CYCLE**

- The pathogen survives as dormant mycelium in the seed or as conidia on the surface of seed for about a year.
- The pathogen also perpetuate on the rotten bolls and other plant debris in the soil.
- The secondary spread is by air-borne conidia.
- The pathogen also survives in the weed hosts, viz., *Aristolachia bractiata* and *Hibiscus diversifolius*.

#### **FAVOURABLE CONDITIONS**

- Prolonged rainfall at the time of boll formation and close planting predispose the disease.

#### **MANAGEMENT**

- Treat the delinted seeds with Carbendazim or Carboxin@2g/kg or Thiram or Captan at 4g/kg.
- Remove and burn the infected plant debris and bolls in the soil.
- Rogue out the reservoir weed hosts.
- Spray the crop at boll formation stage with Mancozeb@0.25% or Copper oxychloride@0.3% or Ziram@0.25% or Carbendazim@0.1%.



# BACTERIAL BLIGHT OR ANGULAR LEAF SPOT OR BLACK ARM

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## ECONOMIC IMPORTANCE

This disease was first observed in Tamil Nadu in 1918. It is an important disease in Maharashtra, Karnataka, A.P., Tamil Nadu and Madhya Pradesh.

## SYMPTOMS

- The bacterium attacks all stages from seed to harvest. Usually five common phases of symptoms are noticed.

### SEEDLING BLIGHT:

- **Small, water-soaked, circular or irregular lesions develop on the cotyledons.** Later, the infection spreads to stem through petiole and cause withering and death of seedlings.

### ANGULAR LEAF SPOT:

- **Small, dark green, water soaked areas develop on lower surface of leaves,** enlarge gradually and become angular when restricted by veins and veinlets and spots are visible on both the surface of leaves.
- As the lesions become older, they turn to reddish brown colour and infection spreads to veins and veinlets.

### VEIN BLIGHT OR VEIN NECROSIS OR BLACK VEIN:

- **The infection of veins causes blackening** of the veins and veinlets, gives a typical 'blighting' appearance.
- On the lower surface of the leaf, bacterial oozes are formed as crusts or scales.
- The affected leaves become crinkled and twisted inward and show withering.
- The infection also spreads from veins to petiole and cause blighting leading to defoliation.





## **BLACK ARM:**

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**On the stem and fruiting branches, dark brown to black lesions are formed, which may girdle the stem and branches to cause premature drooping off of the leaves, cracking of stem and gummosis, resulting in breaking of the stem which hang typically as dry black twig to give a characteristic “black arm” symptom.**

## **SQUARE ROT / BOLL ROT:**

- **On the bolls, water soaked lesions appear and turn into dark black and sunken irregular spots.**
- **The infection slowly spreads to entire boll and shedding occurs.**
- **The infections on mature bolls lead to premature bursting of bolls.**
- **The bacterium spreads inside the boll and lint gets stained yellow because of bacterial ooze and loses its appearance and market value.**
- **The pathogen also infects the seed and causes reduction in size and viability of the seeds.**



# BACTERIAL BLIGHT OR ANGULAR LEAF SPOT OR BLACK ARM

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**Angular leaf spot**



**Boll rot**



**Veinal necrosis**



**Black arm**



## **PATHOGEN : *Xanthomonas campestris pv. malvacearum***

The bacterium is a short rod with a single polar flagellum.

- It is gram negative, non-spore forming and measures 1.0-1.2 X 0.7-0.9  $\mu\text{m}$ .
- The bacterium is aerobic, capsule forming and produces yellow colonies in culture medium.

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### **DISEASE CYCLE**

- The bacterium survives on infected dried plant debris in soil for several years.
- The bacterium is also seed-borne and remains in the form of slimy mass on the fuzz of seed coat.
- It multiplies soon after the seed is sown and infects the seedling through the micropyle.
- Volunteer plants that arise from the bolls falling off prematurely also provide a source of primary infection.
- The bacterium also attacks other hosts like *Thurbaria thespesioides*, *Eriodendron anfructuosum* and *Jatropha curcas*.
- **The primary infection** starts mainly from the seed-borne bacterium.
- The secondary spread of the **bacteria may** be through wind, wind blown rain splash, irrigation water, insects and other implements.
- The bacterium enters through **natural openings or insect caused wounds**.

### **FAVOURABLE CONDITIONS**

- Optimum soil temperature of 28°C, high atmospheric temperature of 30-40°C, relative humidity of 85 per cent, early sowing, delayed thinning, poor tillage, late irrigation and potassium deficiency in soil.
- Rain followed by bright sunshine during the months of October and November are highly favourable.



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# MANAGEMENT

Remove and destroy the infected plant debris.

- Rogue out the volunteer cotton plants and weed hosts.
- Follow crop rotation with non-host crops.
- Early thinning, good tillage, early irrigation, early earthing up and addition of potash to the soil reduces disease incidence.
- Grow resistant varieties like HG-9, BJA 592, G-27, Sujatha, 1412 and CRH 71. Suvin is tolerant.
- *Gossypium herbaceum* and *G. arboreum* are almost immune. *G. barbadense*, *G. hirsutum*, *G. herbaceum var typicum* and *G. herbaceum var acerifolium* have considerable resistance.
- Delint the cotton seeds with **concentrated sulphuric acid at 125ml/kg of seed.**
- Treat the delinted seeds with Carboxin at 2 g/kg seed or soak the seeds in 1000 ppm Streptomycin sulphate overnight or treat the seed with hot water at 52-56°C for 10-15 minutes.
- Spray with Streptomycin sulphate (Agrimycin 100), 500 ppm along with Copper oxychloride at 0.3%