



## Important Foliar Diseases of Cotton (*Gossypium* spp.) Crop

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Cotton (*Gossypium* L.) is a fiber and food crop of high economic importance worldwide. It is also called as “White gold” because of its agricultural as well as industrial importance. Cotton (*Gossypium* sp.) plant is affected by number of biotic factors. Among them few are,

### Blackarm /Angular Leaf Spot /Bacterial Blight

First described in the United States in 1891, bacterial blight has been a major disease in cotton. It is also called angular leaf spot, boll rot and black leg of cotton. Cotton yield losses caused by bacterial blight have been previously reported in excess of 10 per cent. In India, where the crop is grown under irrigation, losses of 5-20 per cent are often experienced.

**Pathogen:** Bacterial blight is caused by a bacterium, *Xanthomonas citri* pv. *malvacearum* (formerly *Xanthomonas axonopodis* pv. *malvacearum*). The pathogen is seed-borne and the disease is transmitted from the cotyledons to leaves, followed by the main stem and bolls.

**Symptoms:** Cotton (*Gossypium* sp.) plant is affected by bacterial blight at all stages of the crop development starting from seedling to maturity. Symptoms at each stage has been given different descriptive nature which is based on plant organ or the growth stage affected, viz., seedling blight, angular leaf spot, vein blight, black arm and boll lesions. The earliest signs of disease may be observed on the cotyledons of young seedlings which is known as ‘cotyledons or seedling blight’. Small dark green ‘water-soaked’ spots, which are circular or irregular in shape become visible on the underside, and then on the upper surface of the cotyledons, usually along the margin. Foliar symptoms are known as angular leaf spot (ALS). Initially, the spots are water-soaked and more obvious on the dorsal surface of the leaf. Another common leaf symptom occurs when lesions extend along the sides of the main veins. This may be seen together with or in the absence of ALS and is referred to as ‘vein blight’. In susceptible cultivars, infection spreads from the leaf lamina down the petiole to the stem. The resulting sooty black lesions give rise to the term ‘black-arm’ by which the disease is commonly called. The lesion may completely girdle the stem, causing it to break in high windy conditions or under the weight of developing bolls.

**Disease cycle:** *Xanthomonas citri* survives in infested crop debris, seeds and volunteer seedlings. Significant rainfall events and high humidity combined with warm temperatures favor disease development. The bacteria enter leaf tissues through the plants natural openings (stomates) and wounds and disease is most severe following storms that produce heavy rains and hail. The bacteria can spread through wind-blown rain or irrigation, as well as unsanitized tools and equipment used in infested fields.

### Management:

- Crop rotation with any other field crop is effective at reducing disease pressure.

- Scout fields and identify infected plants and varieties and remove, destroy them.
- Destroy all stalks and other debris from fields, as soon after harvest as possible. Till debris as deep into the soil as possible, while managing soil erosion.
- Plant high-quality, disease free, acid-delinting cotton seed has been instrumental in minimizing the spread of seedborne bacterial blight through contaminated seed.
- Grow blight-resistant varieties if available.

### Alternaria Leaf Spot

**Pathogen:** Alternaria leaf spot of cotton caused by *Alternaria macrospora* Zimm. and *A. alternata* (Fr.) Keissler.

**Symptoms:** It is a most common foliar disease in all the cotton growing areas of the country. The earliest symptom of the disease is the appearance of spots on the cotyledons of seedlings. In favourable conditions the spots can enlarge to 10 mm in diameter. Large numbers of spots coalesce together causing cotyledons to shed. *A. macrospora* is well known to attack the seedlings in Indian conditions. On green leaves, there is pronounced purple coloured margin all around the spot. On older leaves, the necrotic tissues/spot is often marked by a pattern of concentric structure. In humid weather conditions, the necrotic tissues turn a sooty black colour due to prolific sporulation by the fungus. Severe infection of upper canopy leads to premature defoliation, and is very common among *G. barbadense* and certain cultivars of *G. herbaceum*, widely grown in our country.

**Disease cycle:** The fungus survive on cotton residues if no tissue and alternate host is available. The pathogen spread through air borne spores and water splashing onto healthy plants. Temperatures of about 27°C favour the development of disease.

#### Management:

- Grow resistant varieties if available.
- Maintain plant space for proper air circulation.
- Remove affected plant part and destroy them.
- Provide balance fertilizer to the crop.
- Crop rotation with non-host crop.

### Myrothecium Leaf Spot

**Pathogen:** Myrothecium leaf spot is caused by *Myrothecium roridum*. The fungus (5 patho types) also attacks young and woody stem tissues, causing the development of stem lesions and dieback. The conidia are formed in the cluster from the phialids and are single celled, ovoid to elliptical with tapering ends. The mycelium of the fungus was branched and non-septate. Conidia hyaline or olive green to slightly dark, one-celled, ovoid to elongate or rod shaped with rounded ends.

**Symptoms:** The disease first appears on the young plant leaves only (4 to 6 week), but later may cause pre-emergence and post-emergence damping-off of seedlings. The initial symptom of Myrothecium leaf blight incited by *Myrothecium roridum* appear as small round or oval, brown spots with dark brown margin surrounded by zones of translucent areas forming concentric rings on leaves of the infected cotton plants. After a few days, dark green sporodochia surrounded by a rim of white hair like mycelia are formed particularly in the region where rings are formed.

**Disease cycle:** Spread by conidia present in the infected fallen leaves. Dense crop planting. Favourable temperature 27±2 °C.

#### Management:

- Remove and destroy affected plant parts.
- Follow biological management practices like use of medicinal plant extract, apply *Trichoderma harzianum*, *Pseudomonas fluorescens* etc.
- Spray of Mancozeb or COC at the intimation of disease.
- Foliar spray of Propiconazole 0.1 per cent. Repeat the spray if required.

## Cotton Leaf Curl Virus Disease (CLCuD)

The disease has been reported affecting most of the *G. hirsutum* varieties grown in Punjab, Haryana and Rajasthan. The affected plants remain stunted and their leaves show distinct upward or downward curling. The curling occurs due to the increase in veinal tissues on the abaxial side of leaves. At a later stage, the diseased leaves may develop enations which become prominent with time often originating from the nectaries. The disease is caused by Cotton Leaf Curl Gemini Virus (CLCuD). The virus has two components in their genomes. In nature, the disease is spread by whitefly (*Bemisia tabaci*). The initiation of disease is characterized by small vein thickening (SVT) type symptoms on young upper leaves of plants. Upward/downward leaf curling followed by formation of cup shaped leaf laminar outgrowth of venial tissue on the abaxial side of the leaves are other important symptoms. In severe cases reduction of intermodal length leading to stunting and reduced flowering/fruitletting is also noted. The disease generally appears in the end of June about 45-55 days after sowing and spread rapidly in July. The disease progress becomes slow in August and almost comes to a halt by mid September. Cotton leaf curl virus disease (CLCuD) is caused by a single standard circular Gemini virus consisting of DNA-A and two satellites *i. e* DNA-1 and DNA beta and transmitted by white fly (*Bemisia tabaci*).

## Grey Mildew

**Pathogen:** The is caused by *Ramularia areola*.

**Symptoms:** The disease has been reported from almost all cotton growing areas of the world and known as false mildew. However, in India, it is commonly known as grey mildew. The disease appears first on the lower canopy of older leaves when the plant attains maturity, usually after first boll-set. Irregular to angular pale translucent lesions bound by veinlets and grey powdery growth appear on lower surface of leaf correspondingly light green specks appear on the upper surface of leaves. In severe cases whitish grey powdery growth appear on upper surface. The affected leaves dry up in-ward, turn yellow and fall prematurely. Conidial stage is known as *Ramularia areola* (Atk.) [synonyms, *Ramularia gossypii* Speg. Ciferi, *Cercospora gossypii* Speg.]. It has an ascomycete sexual stage which is known as *Mycosphaerella areola* Ehrlich and Wolf. The fungus develops into three distinct stages during its life cycle. The conidial stage appears on living tissues, mainly on the underside of leaves while they are still attached to plants for a short time after abscission. The spermogonial stage occurs later on the fallen leaves, and this is followed by ascogenous stage which develops on partially decayed leaves which, in turn, help the pathogen to survive in soil.

**Disease cycle:** The pathogen survives during summer in the infected crop residues. The perennial cotton plants and self-sown cotton plants also harbour the pathogen. Primary spread is through conidia from infected plant debris. Secondary spread is through wind, rain splash, irrigation water and implements.

**Condition favours the development of disease are:** Low temperature (20-30 °C), wet humid conditions during winter cotton season. Intermittent rains, close planting, excessive application of nitrogenous fertilizers, very early and late sowing of crop.

### Management:

- Remove and burn the infected crop residues.
- Remove the self-sown cotton plants during summer months.
- Avoid excessive application of nitrogenous fertilizers/manures.
- Adopt correct spacing based on soil conditions and varieties.
- Spray Wettable sulphur @ 400 g /acre or Chlorothalonil @ 200 g / acre or Difenaconazole @ 100 ml or Kresoxim Methyl @ 200 ml/ acre or Tebuconazole @ 200 ml/ acre or Propiconazole @ 200 ml/acre or Metiram 55% + Pyraclostrobin 5% WG @ 200g/ acre or Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC 200ml/ acre at 60, 90 and 120 days after sowing