

Red rot of Sugarcane

C. O.	: <i>Colletotrichum falcatum</i>
Class	: Deuteromycetes
Order	: Melanconiales
Family	: Melanconiaceae
Per. Stage	: <i>Glomerella tucumanensis</i>

In India first reported by Butler (1906). The losses may range from 25-80% and sugar recovery may also reduce. Breeding for resistance work is carried out at Sugarcane Breeding Institute (SBI) at Coimbatore.

Symptoms:

- The first symptoms of red rot in the field are discoloration of the young leaves with reddening of midrib.
- The margins and tips of the leaves wither and the leaves droop.
- The discoloration and withering continues from tip to the leaf base until the whole crown withers and the plant dies, within 4 to 8 days.
- Ultimately this leads to cane rotting. When a diseased plant is open, it emits a characteristic sour odor/ alcoholic smell.
- The tissues are reddened through out the basal portion, specially the vascular bundles, which are intensely red.
- As the disease advances the entire stem rots and the central tissues become pithy. The internodes may shrink.
- Often a profuse whitish growth of fungal mycelium may be found in the centre and pithy tissues.



Favourable conditions:

- High humidity.
- Water logged conditions.
- Ill drained soil.
- Lack of proper cultural operations.
- Condition of the crop, monoculturing, more ratooning will also lead to the epidemics.

Disease cycle:

- The planting material i.e. the setts, may harbor the fungus and thus perpetuate the disease from season to season.
- The fungus may also persist in the soil on diseased clumps dry leaves left behind.
- The primary infection, however appears to be mainly from infected setts.
- In soil the fungus can survive as conidia or chlamydospores up to the six month.
- Secondary spread in the field may be through irrigation water, rain drops and cultivation tools / implements and wind-borne inoculum.
- Stem Infection may take place through insect borer .
- Soil borne fungus may also enter the healthy setts through cut ends, and cause early infection of the shoots.

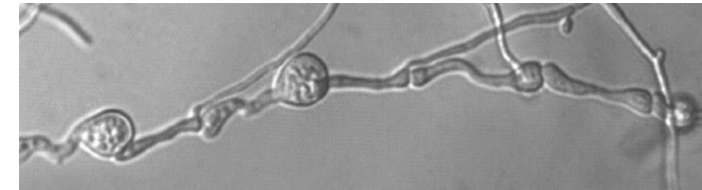
Management:

- Deep ploughing during summer.
- Selection of healthy sets-preferably from ten months old crops having no disease symptoms.
- Thermotherapy: Aerated Steam Treatment (AST) at 50 degree C for 2 hrs and then set steeping in MEMC (emisan 0.2 %) or carbendazim (bavistin 0.2 %) solution for 10 minutes or Moist Hot Air Treatment (MHAT) at 54 °C for 4 hrs. and above chemical steeping.
- Chemotherapy: when there is no facility of thermotherapy plant, then setts can directly treated with the above chemical solution.
- Avoid water logging conditions.
- Judicious use of irrigation and fertilizers. More Nitrogen fertilizers especially urea (more than 250 kg) and flood irrigation leads to more incidence.
- Follow crop rotation: - crop rotation with paddy.
- Inter crop with coriander, soybean, and mustard found effective.
- Avoid ratooning.
- Do not select the seed from ratoon crop.
- Do not allow water from infected field to the healthy.
- Resistant varieties Co-6806, Co-87263, CON 1132, COLK 8001, Co -8338, CoN -85134 12.
- Incorporate bio-control agents i.e. *Trichoderma viride* or *Gliocladium virens*
- Apply organic manures: castor cake, neem cake, poultry manures etc.
- Green manuring with dhaincha.

Whip smut / culmicolous smut of Sugarcane

C.O.	: <i>Ustilago scitaminea</i>
Class	: Basidiomycetes
Order	: Ustilaginales
Family	: Ustilaginaceae

Among the 102 sugarcane growing countries only Australia is free from this disease. The fungus mycelium is present in abundance in the infected canes. The fungus produce chlamydospores.



Symptoms:

- The affected plants are stunted and central shoot is replaced by a long whip like, dusty black structure, several feet in length.
- Excessive tillering and thin canes. In early stages, the structure is covered by a thin silvery white film, which ruptures, exposing the mass of dense, black dust containing smut spores.
- The whip like structure, representing the central shoot with its various leaves, may be produced by each one of the shoots arising from the clump.
- Since the plants are greatly stunted and the black whips stand out prominently in the field, it is easily identified from a distance.



Favourable conditions:

- Optimum temp. for spore germination is about 25⁰ to 30⁰ C, maximum being 36⁰ to 40⁰ C.
- 90-100 % RH is essential for spore germination.

Disease cycle:

- ✓ Sugarcane crop has no off season and the disease easily gets ready hosts.
- ✓ The mode of transmission of the disease through the fungal mycelium contained in the setts taken from diseased clumps.
- ✓ The healthy setts can also become infected by soil- borne spores.
- ✓ In a ratoon crop the fungus left over in the clumps becomes more active.
- ✓ The fungus attacks other graminaceous plants i.e. *Saccharum spontaneum*.



Management:

- Removal of smutted whips from the infected field.
- Discourage the practices of ratooning.
- Avoid planting infected setts: Selection of healthy seed from healthy field.
- Disinfection of sets before planting
- Chemotherapy: MEMC / agallol / bagalol/aretan/emisan 0.2 % or carbendazim 0.1 % solution-dip setts for 10 min.
- ✓ Thermotherapy: Hot Water Treatment (HWT) 55⁰ to 60⁰ C, for 10 min. dip.
 - Aerated Steam treatment (AST) 50⁰ C / 2 hrs.
 - Moist Hot Air Treatment (MHAT) at 54⁰ C / 4 hrs.
- Crop rotation with non-host crop.
- Roughing before rupturing of silver membrane of whip and destroying them.
- Avoid planting of susceptible varieties and use resistant varieties CO-6806.
- Deep ploughing in summer and flooding the field will destroy soil inoculum.
- Do not take sets from infected field.

Wilt:

C.O.: *Fusarium moniliforme* var. *subglutina*

It was first reported by Butler and Khun (1913) from India. The yield loss is 10-80%.

Symptoms:

- Typical wilt symptoms appear during the monsoon periods.
- The affected plants, either singly or in small groups displays a conspicuous stunting and unthrifty appearance.
- The yellowing or withering of crown leaves.
- The mid rib of leaves turn yellow while leaf lamina remains green.
- On splitting open the canes, at early stages of infection, diffused purple or muddy red colour is seen at each node.
- These canes emit a characteristic disagreeable smell.
- Luxuriant fungal growth at nodal portion in cavity may also produced roots may also get blackened.



Disease cycle:

- Primary source of inoculum: chlamydospores & infected seed setts (seed borne).
- The fungus can also survive in soil (soil borne) as a saprophyte for 2-3 years.
- Secondary spread of macro, micro conidia is through water or soil contamination .

Favourable conditions:

- Ill drained soils.
- Heavy irrigation.
- Water logging and water stress conditions.
- High soil pH (<7.0)
- More Nitrogenous fertilizers.
- Monoculturing especially with single susceptible genotype.
- Imbalance use of nutrients.
- No crop rotation.
- More ratooning.
- More root borer and nematode damage increases the disease.
- High C: N ratio.
- Pre monsoon drought followed by excessive water.
- Use of diseased setts leads to more infection.

Management:

- Deep ploughing during summer.
- Selection of healthy setts.
- Seed set treatment at 54 °C or 52°C for 4 hrs and then steeping in MEMC 0.2 % or carbendazim 0.1 % solution for 5-10 minutes.
- Roughing -Infected clump should be uprooted, and burnt and drench that portion with MEMC 0.2 % or carbendazim 0.1 % solution.
- Avoid ratooning, do not select the setts from ratoon crop.
- Facilitate the field with proper drainage.
- Avoid water logging or water stress conditions.
- Judicious use of irrigation and fertilizer.
- Crop rotation-sugarcane-paddy (summer) + paddy (kharif) + Green manuring with Dhaincha (kharif end) – then sugarcane.
- Mulching with sugarcane trash.
- Use organic manure- castor, neem, poultry cakes or FYM or Press mud.
- Don't allow water from infected field to healthy fields.
- Resistant variety-C0-8338, CoN- 91 132, CoLk- 8001.
- Apply *Trichoderma viride* or *T. harzianum* or *T. longibrachyatum*.
- Application of carbofuran @ 1.5 kg.a.i./ ha. first 30 days after planting, second at the time of earthing up to manage borer/ nematodes.

Grassy Shoot of sugarcane

C.O.: **Mycoplasma like organism (MLO's)**

Mycoplasma (plural mycoplasmas or mycoplasmata) is **a genus of bacteria** that lack a cell wall around their cell membranes.

It is also known as yellowing or white leaf diseases (albinism)of sugarcane in India, Taiwan and Thailand. This is one the serious disease of sugarcane especially in Maharashtra and was first time reported during 1949.

Based on Gram Reaction

1. Gracilicutes
2. Fermicutes
3. Tenericutes

Kingdom	:	Bacteria
Division	:	Tenericutes
Class	:	Mollicutes
Order	:	Mycoplasmatales
Family	:	Mycoplasmataceae
Genus	:	<i>Mycoplasma</i>

Symptoms:

- The disease shows different types of symptoms at different stages of plant growth and has been described as "Bunchy disease" or "leaf tuft".
- Profuse tillering.
- The most pronounced symptom is the grassy appearance.
- Shoots growing from diseased setts remain dwarf and stunted.
- The leaves are narrow and small, like grass leaves.
- The canes are thin with short internodes, giving a bunchy or grassy appearance to the clump.
- The leaves appear yellow and in some cases may be entirely devoid of any pigment (white leaf or albinism).
- In secondary infection, the new leaves and internodes show the above symptoms.
- Leaves exhibit straight, long, white or light green or yellowish streaks.
- The lower nodes produce large numbers of grassy shoots.
- In systemically infected canes the disease appearing in May-June



Disease cycle:

Primary source of infection: Sett borne.

Secondary source of infection: Transmitted by sap inoculation through aphid *Longiunguis sacchari*, *Melanapsis indosacchari* and *Aphis maydis* vectors.

Other hosts: Jowar. Napier grass, Madras grass.

Management:

- Selection of healthy sets for planting.
- During early stages of the crop, protect the crop by controlling insect vectors- by spraying systemic insecticide. (malathion 0.16 %).
- Infected clumps should be dug out and destroyed.
- Thermotherapy to setts before planting: - Sett treatment -HWT 50 degree C / 2 hrs. or HAT 54 degree C / 8 hrs.
- Chemotherapy to setts: - Tetracycline (250 ppm) applied to seed setts have been found effective to eliminate the organism.

Ratoon stunting of Sugarcane

Clavibacter xyli pv. *xyli* (Xylem limited fastidious bacteria)

Economic importance

The disease is present throughout the sugarcane growing areas of our country. **CO 419** variety was worst affected in parts of Karnataka where it was withdrawn from cultivation.

The disease appears in both plant and ratoon crop, but more pronounced in ratoon crop.

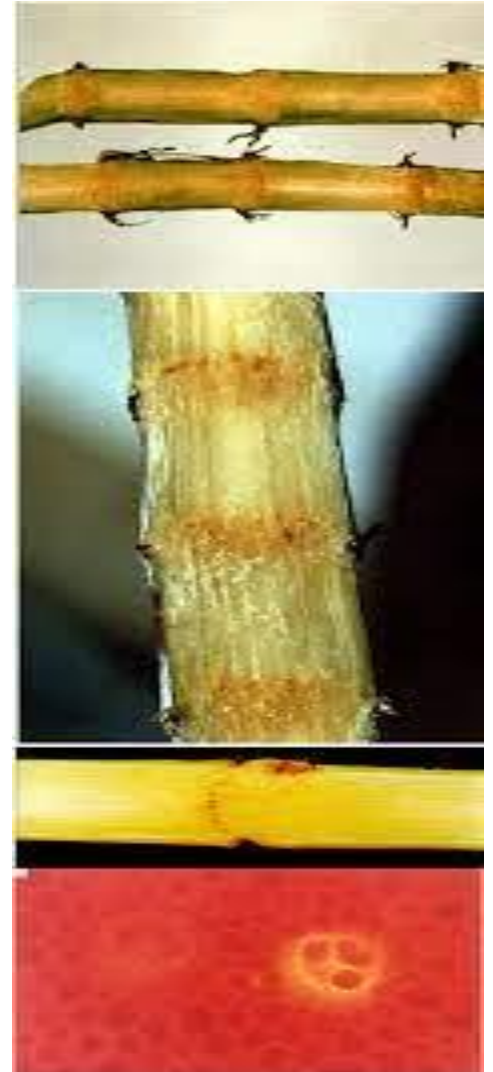
Symptoms

Diseased clumps usually display **stunted** growth, reduced tillering, thin stalks with shortened internodes and yellowish foliage (**mild chlorosis**).

When mature canes are split open, vascular bundles appear discoloured.

In young canes, **pink colour** is seen in the form of minute pin head like areas near the nodes.

The disease reduces the length, girth and the number of canes per clump.



Pathogen

The pathogen is known to present in the xylem cells of infected plants. They are small, thin, rod shaped.

Disease cycle

The disease spreads through use of **diseased setts**. The disease also spreads through cane harvesting implements contaminated with the juice of the diseased canes. **Maize**, **sorghum**, **Sudan grass** and *Cynodon* are some of the collateral hosts of the pathogen.

Management

- Select the setts from disease free field.
- Remove and burn the clumps showing the disease.
- Sterilization of cutting knives with any antiseptic solution.
- Hot air treatment of setts at 54 degree C for 8 hours or hot water treatment at 50 degree C for 2 hrs or aerated steam treatment at 50 degree C for 1 hour.

Pokkah Boeng Disease of Sugarcane

CO: *Fusarium moniliforme* var. *subglutinans*
Fusarium sacchari

Survival and spread

This is an air-borne disease and primarily transmitted through the air-currents and secondary transmission is through the infected setts, irrigation water, splashed rains and soil.

Favourable conditions

20-30°C temperature and the average relative humidity higher than 70 to 80% with a cloudy weather, drizzling rains favors the growth of pathogen.

Symptoms

- Chlorotic Phase: The earliest symptom of Pokkah boeng is a chlorotic condition towards the base of the young leaves and occasionally on the other parts of the leaf blades. Frequently, a pronounced wrinkling, twisting and shortening of the leaves accompanied the malformation or distortion of the young leaves. The base of the affected leaves is seen often narrower than that of the normal leaves.
- Acute Phase or Top-Rot Phase: The most advanced and serious stage of Pokkah boeng is a top rot phase. The young spindles are killed and the entire top dies. Leaf infection sometimes continued to downward and penetrates in the stalk by way of a growing point. In advanced stage of infection, the entire base of the spindle and even growing point showed a malformation of leaves, pronounced wrinkling, twisting and rotting of spindle leaves. Red specks and stripes also developed.
- Knife-cut Phase (associate with top rot phase): The symptoms of knife-cut stage are observed in association with the acute phase of the disease characterized by one or two or even more transverse cuts in the rind of the stalk /stem in such a uniform manner as if, the tissues are removed with a sharp knife, This is an exaggerated stage of a typical ladder lesion of a Pokkahboeng disease.

1. Chlorotic phase



2. Top rot phase



3. Knife cut phase



Management

- Planting healthy seed material.
- Spraying different fungicides, such as Bavistin (1 g per l of water) or Blitox (2 g per l of water) or copper oxychloride or Dithane M-45 (3 g per l of water).
- Two to three sprayings with an interval of 15 days interval reduces the multiplication of a pathogen and losses in yield and quality of cane
- Canes showing 'top rot' or 'knife cut' should be rouged out from the fields