

Diseases of Sugarcane

Disease group	Name of the disease	Causal organism
Fungal	Brown spot	<i>Cercospora longipes</i>
	Yellow spot	<i>Cercospora koepkei</i>
	Downy mildew	<i>Sclerospora sacchari</i>
	Eye spot	<i>Bipolaris sacchari</i>
	Pineapple disease	<i>Ceratocystis paradoxa</i>
	Pokkah boeng	<i>Fusarium moniliforme</i> [anamorph] <i>Gibberella fujikuroi</i> [Perfect stage]
	Red rot	<i>Colletotrichum falcatum</i> [anamorph] <i>Glomerella tucumanensis</i> [Perfect stage]
	Ring spot	<i>Leptosphaeria sacchari</i>
	Root rots	<i>Pythium</i> sp., <i>Fusarium</i> sp. <i>Rhizoctonia</i> sp.
	Common Rust	<i>Puccinia melanocephala</i>
	Smut	<i>Ustilago scitaminea</i>
	Wilt	<i>Fusarium sacchari</i> = <i>Cephalosporium sacchari</i>
Bacterial	Gumming disease	<i>Xanthomonas campestris</i> pv. <i>vasculorum</i>
	Leaf scald	<i>Xanthomonas albilineans</i>
	Ratoon stunting disease	<i>Clavibacter xyli</i>
	Red stripe (top rot)	<i>Pseudomonas rubrilineans</i>
Viral	Mosaic	<i>Sugarcane Mosaic Virus</i>
MLOs	Grassy shoot	Pytoplasma (Mycoplasma like organism-MLO)
	White leaf	Pytoplasma (Mycoplasma like organism-MLO)
Parasitic plant	Phanerogamic parasitic plant disease	<i>Striga densiflora</i>
Nematode	Lesion	<i>Pratylenchus</i> spp.
	Root-knot	<i>Meloidogyne javanica</i>

Disease name: Red rot of sugarcane

Causal organism: *Colletotrichum falcatum* [anamorph]
Glomerella tucumanensis [Perfect stage]

Symptoms:

The disease is recognized when canes are nearing maturity. The first symptom of red rot in the field is discolouration of the young leaves. Usually third or the fourth leaf from the top turns paler and droops slightly. The tip dries and withering progresses toward along the margin, leaving the central areas green. In the infected plants the leaves may show symptoms in the form of dark red lesions in the mid-rib, which may elongate, turning blood-red with dark margins. In mature lesions the centre become straw coloured and the black dot like acervuli develop on it. When the infected canes are split open they give out an alcoholic smell due to fermentation and infected tissues are found red color interrupted by occasional whitish patches in the internodal tissues. The reddening is most intense in the vascular bundles and extends to the pith. Finally the pith dries, the rind shrinks and the canes become lighter in weight and easily broken.



Perpetuation/Overwinter: The disease is perpetuated from year to year by planting sets from infected canes and also through the fungus that remains viable on diseased canes lying in the field or ratooning of the crop.

Favourable Conditions

- Monoculturing of sugarcane.
- Successive ratoon cropping.
- Water logged conditions and injuries caused by insects.

Disease cycle:

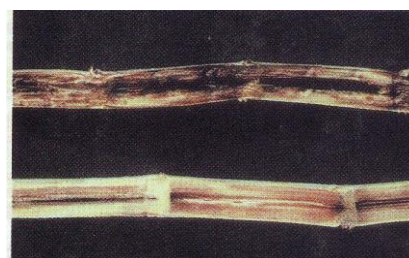
The planting material, viz., the setts, may harbour the fungus and thus perpetuate the disease from season to season. The fungus may also persist in the soil if diseased clumps and dry leaves left in the field after harvest. The primary infection, however, appears to be mainly from infected setts. Secondary infection takes place by the spores produced on the affected canes and on the mid rib of the leaves. Secondary spread in the field may be through irrigation water, cultivation tools and implements and wind-borne inocula. The fungus also survives on collateral hosts *Sorghum vulgare*, *S. halepense*, and *Saccharum spontaneum*. If the conidia settle on the leaves they may germinate and invade the leaves through various types of wounds including the splitting of the mid-rib so common in many varieties. Stem infection may take place through borer tunnels, root primordial and seed cuttings. The soil-borne fungus may also enter the healthy setts through cut-ends, and cause early infection of the shoots. The prevalence of several pathogenic strains of the fungus has been reported from many countries. Though the perfect stage of the fungus has been observed in nature, the role of ascospores in the disease cycle is not understood.

Control measures

1. The best remedy for avoiding this fungal disease is to cultivate only resistant sugarcane varieties such as Iswardi 2/54, Iswardi-16, Iswardi-17.
2. Healthy setts only are to be planted to avoid poor plant stand due to rotting.
3. Hot water treatment of setts before planting at 52°C for 30 minutes is also recommended.
4. Before planting, the setts should be momentarily dipped in Aratan-6 solution (1/2 lb. per 23 gallons of water) to protect the mother setts from invasion by the fungus.
5. Cut ends may be dipped in coal tar before planting the setts.
6. Ratooning of infected fields should be strictly avoided.
7. After harvest, all the plant debris and diseased materials should be destroyed by burning.
8. Control of borers and improve of drainage in cane field.

Disease name: Stem canker or Wilt of sugarcane

Causal Organism: *Cephalosporium sacchari*



Symptoms

- The first symptoms of the disease become apparent only when the plant has grown for about 4-5 months.
- The leaves of affected clumps gradually turn yellow and dry up and causing wilting of cane.
- On longitudinal splitting of affected clumps, the pith will be seen discoloured like purple or dark red colored at near the node
- A characteristic disagreeable odour is also associated with such diseased canes.
- A cottony white mycelium can also be seen in the pith region.

Dissemination

The fungus remains in diseased canes or plant debris, which remains lying in the fields after the harvest of crop. Ratoon crop also helps the disease causing fungus to survive. The fungus is transmitted from place to place through the infected seed setts, air, rain water and also irrigation water. The pathogen penetrates to the base of cane and below soil through wound. The fungus can also survive in soil as a saprophyte for 2-3 years. Near-neutral and alkaline soils are favoured by the fungus.

Favourable Conditions

- High day temperature (30-35 °C).
- Low humidity (50-60%).
- Low soil moisture and alkaline soils.
- Excess doses of nitrogenous fertilizers

Control measures

1. Planting disease free setts and use of resistant varieties will be more practicable and economical control measure.
2. Alkaline soils may be avoided for growing the crop.
3. The destruction of cane plant debris alone would control the disease in alkali soils.
4. The setts should be dipped in Bavistin fungicide solution (0.1%) for 30 minutes before planting.
5. Ratooning of the diseased crop should be discouraged

Disease name: White leaf disease of sugarcane

Causal organism: Phytoplasma (Mycoplasma Like Organism-MLO)

Symptoms

Initially, a single white or cream line parallel to the midrib occurs. Later, several straight white to light green to yellow stripes develops parallel to the midrib develop extending along the entire leaf length, but rarely onto the upper portion of the leaf sheath. A mottled pattern of normal or light green dot, spot, streak or patch islands may develop on a white background, varying in size and shape. As the disease develops, the plant vigour decreases. Others symptoms are stunted stalks, absence of side shoots on the upper part of infected stalks and abnormal tillering.

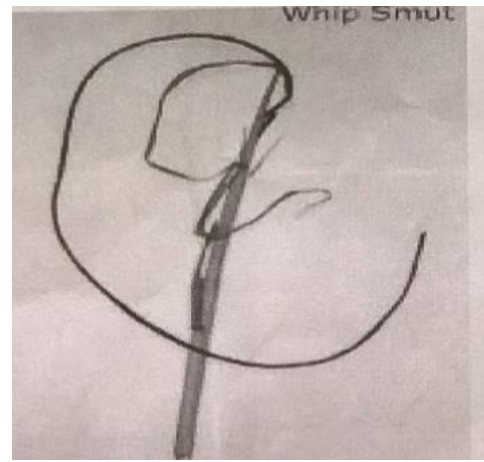


Disease name: Whip Smut

Causal organism: *Ustilago scitaminea*

Symptoms:

The affected canes produce long, black whip-like and coiled or curved shoots, which are covered with a thin silvery membrane, containing masses of spores of the fungus. The smutted shoots arise from the growing point of the cane. On maturity it ruptures and millions of tiny black smut spores (teliospores) are liberated and disseminated by the wind, which contaminate soil and the standing crop. In certain cases, the infected plants remain stunted in growth with many tillers having small and narrow leaves.



Disease dissemination: The disease is carried over from year to year by the mycelium in the infected ratooning or planting setts and by soil borne spores. The primary transmission of the disease is through diseased seed pieces, while the secondary transmission is through wind blown spores. These smutted spores present in or on the soil surface are also disseminated from one place to another by rain, irrigation water and infection may also take place in new plant.

Favourable Conditions

- Monoculturing of sugarcane.
- Continuous ratooning and dry weather during tillering stage.

Disease cycle

Teliospores may survive in the soil for long periods, up to 10 years. The spores are also present in the infected plant materials in the soil. The smut spores and dormant mycelium also present in or on the infected setts. The primary spread of the disease is through diseased seed-pieces (setts). In addition, spores present in the soil also spread through rain and irrigation water and cause soil-borne infection. The secondary spread in the field is mainly through the smut spores developed in the whips, aided by air currents. The fungus also survives on collateral hosts like *Saccharum spontaneum*, *S. robustum*, *Sorghum vulgare*, *Imperata arundinacea* and *Cyperus dilatatus*.

Control: Following measures are suggested for prevention as well as control of the disease:

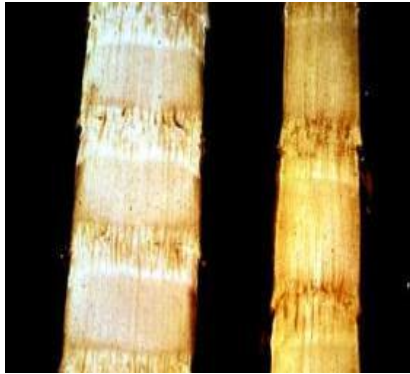
- 1) Setts from smutted canes should not be used for planting.
- 2) Smutted plants should be rouged out and burnt before the bursting of the spores.
- 3) Use of resistant varieties should be encouraged.
- 4) Avoid ratooning infected field.
- 5) 95% moist hot air at 54 °C for 4 hours or Hot water treatments of setts at 50 °C for 3 hours can help to eliminate the internal infection,
- 6) Seed-sets should be disinfected either in 0.1 % mercuric chloride or formaline solution for 5 minutes followed by 2 hours covering under a moist cloth. The other effective chemicals available in market may also be used.
- 7) Crop rotation.

Disease name: Ratoon stunting disease (RSD)

Causal organism: *Clavibacter xyli* (Rickettsia Like Organism - RLO)

Symptoms

Ratoon stunting disease does not show any specific external symptoms usually found in the majority of plant diseases. The external expression of the disease usually display stunted growth, reduced tillering, thin stalks with shortened internodes and yellowish foliage. If a diseased stalk is sliced longitudinally with a sharp knife the discoloration found in the node of mature canes is in the shape of dots or commas and a general pink color in the nodes of very young canes. The color range includes yellow, orange, pink, red and reddish brown



Discolouration of the nodal and internodal regions of sugarcane stem



Distinct creamish discoloration on the internode of diseased stalk



Typical symptom of ratoon stunting disease

Dissemination

- The disease spreads mainly through planting material; setts should be selected from healthy plants.
- Knives, sickle, or agricultural equipments used in cane field

Control measures

1. Adequate irrigation particularly in the early stages of growth especially in plant crops, and in the less susceptible varieties
2. The provision of healthy planting materials
3. The use of resistant varieties
4. Hot water treatment of setts at 50 °C for 3 hours
5. Sterilization of cane knives with 20% solution of "lysol"
6. Establishment of clean seed nursery for source of planting material.

Disease name: Sett rot or Pineapple disease of sugarcane

Causal organism: *Ceratocystis paradoxa*

Symptoms

- The disease primarily affects the setts usually two to three weeks after planting
- When diseased setts are planted they may rot before germination, or the shoots may die after reaching a height of about 6-12 inches.

- The affected tissues first develop a reddish colour which turns to brownish black in the later stages and the contents of the sett rotting.
- The severely affected setts show internodal cavities covered with the mycelium and abundant spores
- A characteristic pineapple smell is associated with the rotting and hence the name.
- If infected shoots survive, they are very much stunted and chlorotic.



Favourable Conditions

- Poorly drained fields.
- Heavy clay soils
- Temperature of 25-30 °C
- Prolonged rainfall after planting.

Control measures

1. Healthy setts should be obtained from disease-free field.
2. Soak the setts in 0.05% Carbendazim 15 minutes before planting, to protect the cut-ends from invasion by the fungus.
3. Pretreating the setts with hot water has been found to stimulate germination of buds and hasten growth so as to help the young plants to overcome the competition with the pathogen.
4. Field sanitation practices combined with chemical pre-treatment of the setts are quite effective in controlling the disease.
5. Provide adequate drainage during rainy seasons.

Disease name: Leaf scald of sugarcane

Causal organism: *Xanthomonas albilineans*

Symptoms

The most typical symptom is a white pencil-line streak about 1-2 mm wide on the leaf that extends from the midrib to the leaf margin running parallel to the veins. As the disease progresses, necrosis develops from the leaf tip or leaf margin. On mature stalks, side shoots first appear from each node at the bottom of the stalk and progress upward. These side shoots usually show the scalding and/or white pencil lines. Internally, affected stalks may show bright to dark red streaks caused by necrosis of the vascular bundles. The acute phase is characterized by a sudden wilting and death of mature stalks, often without previous symptom expression.



Pencil-line mark on sugarcane leaf caused by leaf scald disease.



Sugarcane side shoots infected with leaf scald.



Typical white streaking of the leaves found on sugarcane plants

Prevention and control

The best control is prevention and the replacement of susceptible varieties with resistant varieties. Setts can be given a long-hot-water treatment to kill the pathogen. To prevent mechanical spread of the pathogen, all cane cutting knives, including those on mechanical harvesters, should be sterilized when coming from suspect fields.

Disease name: Mosaic of sugarcane (*Sugarcane Mosaic Virus*)

Symptoms

The disease appears more prominently on the basal portion of the younger foliage as chlorotic or yellowish stripes alternate with normal green portion of the leaf. As infection becomes severe, yellow stripes appear on the leaf sheath and stalks. Elongated necrotic lesions are produced on the stalks and stem splitting occurs. The necrotic lesions also develop on the internodes and the entire plant becomes stunted and chlorotic.



Chlorotic streaks showing the leaf symptoms of mosaic disease

Dissemination: Transmitted through mosaic infected setts and an aphid.

Alternate hosts: Maize and sorghum.

Control measures

1. Digging out and destroying infected plant by burning.
2. Rogue out the diseased clumps periodically.
3. Planting virus free setts and avoid ratooning of diseased crop.
4. Aerated Steam Therapy (AST) at 56°C for 3 hrs, for setts before planting is advised.
5. Growing resistant varieties.
6. Take action to control insect vector timely.

Disease name: Red-Stripe & top rot of Sugarcane

Causal Organism: *Pseudomonas rubrilineans*

Symptoms

- Red stripe is characterized by the appearance on the leaves of chlorotic lesions carrying dark red stripes either distributed all over the blade, or concentrated in the middle
- Several of them may coalesce to cover large areas of the leaf blade; initially these appear as water-soaked green stripes and then soon turn as dark red lesions on lower and upper surface of the leaf.
- In severe infection, the rotting may commence from the tip and spread downwards and to cause shoot or top rot
- If the affected canes are cut by splitting the shoot downwards, the vascular bundles exude foul smelling yellowish gum; dark red discoloration of the tissues may be seen.

**Dissemination**

The disease spreads in the field by wind and rain, and by cutting. The bacterial cells falling on the host plants, enter them through natural openings or wounds and establish themselves in the various tissues, including the xylem.

Favourable Conditions

- Continuous ratooning and prolonged rainy weather with low temperature (25⁰ C)

Control measures

- This is a difficult disease of sugarcane to control.
- When-ever the disease is noticed, the affected plants should be removed and burnt.
- Such systematic destruction of the affected plants reduces the disease incidence.
- Growing resistant varieties is, however, the best method of control.
- Disease free certified setts should be used.

Disease name: Root-Knot disease of sugarcane

Casual Organism: *Meloidogyne javanica*

Symptoms

- The diseased plants are chlorotic and stunted, and yellow stripes show on the young leaves while older leaves appear healthy.
- When the roots of affected plants are dug out and examined, they are found to be knotted.
- The nematode is found inside the knots and take up juice resulting in some cases plants are died.

Disease Dissemination

The nematode eggs persist in soil, female adult associate with root knot form and when the susceptible host is planted, the cyst give rise to the larval forms which invade the root and form the galls. Once the larvae are inside the host tissue, they feed through the vascular bundles and complete the life cycle.

Control

- The root-knot nematode can be checked by fumigating the soil with a nematicide such as Carbofuran/ Furadan 3G or 5G.
- The soil must be opened up soon after crop harvest.
- The soil is safe for planting in 2-3 weeks after fumigation.
- In some countries crop rotation with marigold reduces the nematode population.

Disease name: Pokka Boeng

Causal organism: *Fusarium moniliforme* [anamorph]

Gibberella fujikuroi [Perfect stage]

Symptoms

The initial symptoms of the disease are chlorotic areas at the base of young leaves, followed by distortion (wrinkling and twisting) and shortening of affected leaves. In severe cases, death of the stalk will occur. The base of affected leaves is often narrower than that of normal leaves. As leaves mature, irregular reddish stripes and specks develop within the chlorotic parts. The reddish areas sometimes develop into lens-shaped holes which have no definite arrangement. This reddish tissue may form ladder-like lesions, often with dark edges. Leaf sheaths may also become chlorotic and develop irregular necrotic areas of reddish color. The infection in the spindle sometimes continues downward into the stalk and dark reddish streaks may be found extending through several internodes. Also, in the internodes, the infection may form long lesions with cross depressions that give them a ladder-like appearance. These lesions sometimes break through the surface of the rind, fungi also cause a wide range of symptoms such as seedling blight, scorch, stalk rot, root rot, wilt, and stunting in different crops.



Figure 1. Pokkah boeng leaf symptoms



Figure 2. Pokkah boeng stalk symptoms

Spread of the Disease:

The spread of pokkah boeng is mainly by airborne spores (Vishwakarma *et al.* 2013). Dissemination of the disease by seed pieces may occur but is considered of little importance. Infection usually occurs through the spindle along the margin of a partially unfolded leaf. Spores which enter the spindle germinate and grow into the inner tissue of the spindle leaves. The fungus reaches the immature portion of the stem by way of the vascular bundles. It may pass through the vascular bundles of the leaf sheath without entering the surrounding tissue, but ladder-like lesions are often found in the sheath. Pokkah boeng appears to be favored by a wet season followed by dry climatic conditions. Sugarcane that is three to seven months old and growing vigorously appears to be the most susceptible.

Prevention and Control: Pokkah boeng is seldom serious enough to warrant concern or control. However, if control is desired, the only satisfactory control measure for pokkah boeng is the use of resistant sugarcane cultivars.