The background features a collage of sugarcane-related images. On the left, there is a field of tall, green sugarcane stalks. On the right, there are detailed illustrations of sugarcane inflorescences, including a pinkish one and a purple one. At the bottom, there are several cut sugarcane stalks showing their reddish-brown outer rind and the pale, fibrous inner pith.

# **DISEASES OF SUGARCANE CROP**

Session-2

M.S.Swaminathan School of Agriculture,CUTM



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# MAJOR DISEASES OF SUGARCANE

## FUNGAL DISEASES

**RED ROT**

*Colletotrichum falcatum*  
(Sexual stage: *Physalospora tucumanensis*  
or *Glomerella tucumanensis*)

**WHIP SMUT**

*Ustilago scitaminea*

**WILT**

*Cephalosporium sacchari*

**RING SPOT**

*Leptosphaeria sacchari*

**SETT ROT OR PINEAPPLE DISEASE**

*Ceratocystis paradoxa*

**POKKAH BOENG**

*Fusarium moniliformae*

## BACTERIAL DISEASES

**GUMMOSIS OR GUMMING DISEASE**

*Xanthomonas campestris pv. vasculorum*

**RATTON STUNT OF SUGARCANE**

*Clavibacter xyli pv. xyli (Leifsonia xyli)*



# MAJOR DISEASES OF SUGARCANE

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<b>PHYTOPLASMA DISEASE</b>	
<b>GRASSY SHOOT</b>	<i>Phytoplasma</i>
<b>VIRAL DISEASE</b>	
<b>MOSAIC</b>	<i>Sugarcane Mosaic Virus</i>
<b>NEMATODE</b>	
<b>ROOT KNOT NEMATODE</b>	<i>Meloidogyne javanica</i>



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# SYMPTOMS CONTINUE

These include the **reddening of the internal tissues, especially the vascular bundles**, which are usually **elongated at right angles to the long axis of the stalk.**

- The presence of **cross-wise white patches interrupting the reddened tissues are the important diagnostic character of the disease.**
- Split open stems emit a characteristic **acidic-sour odour.**
- **As the** disease advances the entire stem rots and the stalk becomes hollow and covered with white mycelial growth.
- Later the rind shrinks longitudinally with minute black, velvety fruiting bodies protruding out of it.
- The pathogen also produces tiny reddish lesions on the upper surface of leaves with dark dots in the centre.
- Minute **red spots also appear on the centre of the mid-rib and develop** in both directions forming small or long lesions.
- The lesions are initially blood red with dark margins and later on with straw coloured centres.
- Often the infected leaves may break at the lesions and hang down, with large number of minute black dots.



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# RED ROT SYMPTOM IN LEAF





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# RED ROT SYMPTOM IN CANE





# ETIOLOGY

**CAUSAL ORGANISM:**

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**Imperfect stage:** *Colletotrichum falcatum*

*(Sub-division-Deuteromycotina, Order-Melanconiales, Family-Melanconiaceae)*

**Sexual stage:** *Physalospora tucumanensis or Glomerella tucumanensis*

- The fungus produces thin, hyaline, septate, profusely branched hyphae containing oil droplets.
- The fungus produces black, minute velvety **acervuli with long, rigid bristle like**, septate pointed setae on the surface of rind, leaf midrib and sometimes in the pith region.
- Conidiophores are closely packed inside the acervulus, which are short, hyaline and single celled measure about  $20 \times 8 \mu$ .
- The conidia are single celled, hyaline, **falcate, granular and guttulate** measure about  $16-48 \times 4-8 \mu$ .
- The perfect stage of the fungus produces large number of globose and dark brown to black perithecia with a papillate ostiole. Asci are clavate, unitunicate and eight spored.
- Large number of hyaline, septate, filiform paraphyses is also present among asci.
- Ascospores are ellipsoid or fusoid, hyaline, straight or slightly curved and unicellular.



# PATHOGEN

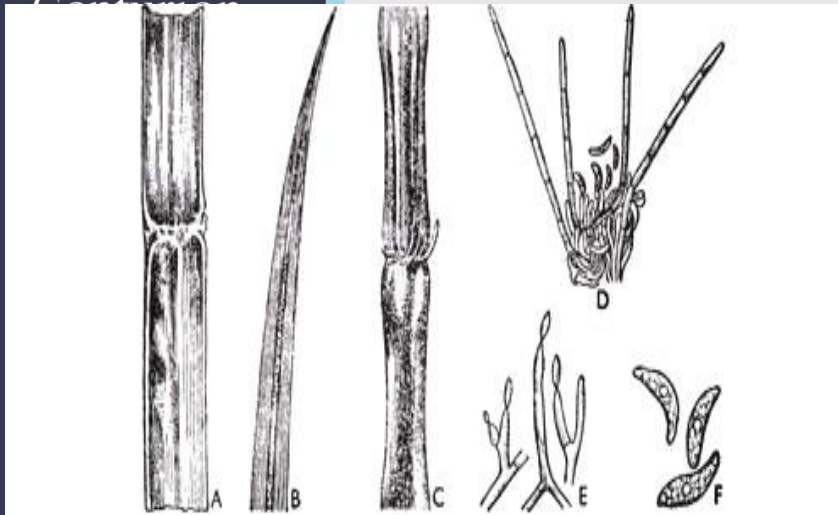
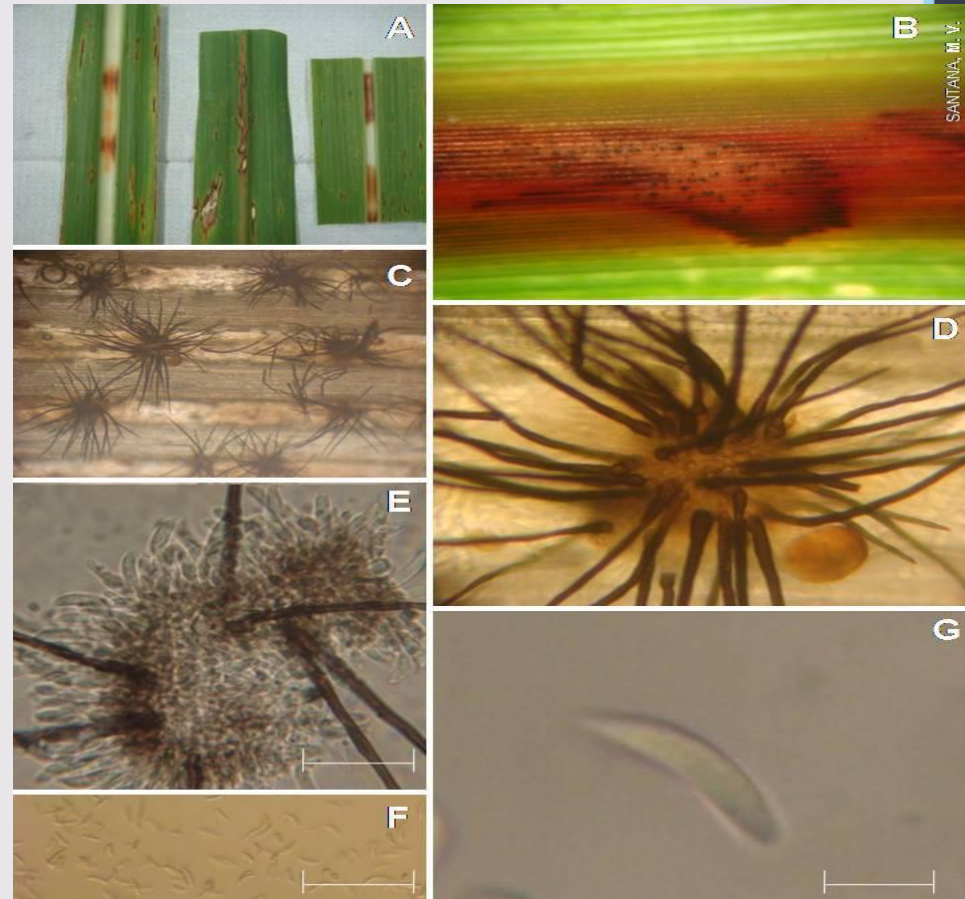


Fig. 374. Red Rot of sugarcane. A—C. Disease symptoms. A and C. On stem. B. On leaf. D. An acervulus. E. Conidiophores producing conidia. F. Conidia.



**A.SYMPTOM IN LEAF,B.BLACK COLOUR ACERVULI ON INFECTED PART,C,D BLACK COLOUR ACERVULI WITH SETAE, E,F,G. BLACK COLOUR ACERVULI WITH SETAE WITH CONIDIA**





## DISEASE CYCLE

- The fungus is sett-borne. The fungus also persists in the soil on the diseased clumps and stubbles as **chlamydospores and dormant mycelium**.

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- **The primary infection is mainly from infected setts.**

- **Secondary spread in the field may be through irrigation water and cultivation tools.**
- The rain splash, air currents and dew drops also help in the spread of conidia from the diseased to healthy plants in the field.
- The fungus also survives on collateral hosts like *Sorghum vulgare*, *S. halepense* and *Saccharum spontaneum*.

## FAVOURABLE CONDITIONS

- Mono-culturing of sugarcane, successive ratoon cropping, water logged conditions and injuries caused by insects favourable for disease development.



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# MANAGEMENT

- Removal and destruction of infected plant debris, stubbles and trash.
- Deep tillage to incorporate the left over debris.
- Adopt crop rotation by including rice and green manure crops.
- Select the setts from the disease free fields or disease free area.
- Avoid ratooning of the diseased crop.
- Avoid flow of irrigation water from diseased to healthy plants.
- Soak the setts in 0.1% Carbendazim solution for 20 minutes before planting.
- Hot water treatment of setts at 52°C for 30 min or 50°C for 2 hours followed by steeping in 0.1% carbendazim solution.
- Setts can be treated with aerated steam at 52°C for 4 to 5 hours and by moist hot air at 54°C for 2 hours.
- Grow resistant varieties like CO 6907, CO 7219, CO 8013, CO 8021, CO 7706, CO A 7602, CO A 89082, CO A 89085, 87 A 397, CO T 8201, etc.



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# WHIP SMUT

## ECONOMIC IMPORTANCE

- It is considered as an important disease and is common throughout the world. In India, it is widely prevalent in almost all the sugarcane growing tracts.

## SYMPTOMS

- The affected plants are stunted and the central shoot is converted into a **long whip-like, dusty black structure**.
- **The length of the whip varies from few inches to several feet.**
- In early stages, this structure is covered by a thin, white papery membrane.
- The whip may be straight or slightly curved.
- On maturity it ruptures and millions of tiny black smut spores (**teliospores**) are **liberated and disseminated by wind**.
- **All the shoots arising from the** diseased clump produce whip like structures.
- The smutted clumps also produce mummified arrows in which lower portion consists of normal inflorescence with typical flowers and the upper portion of the rachis is converted into a typical smutted whip.
- Occasionally smut sori may develop on the leaves and stem..
- The ratoon crops are severely affected.



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# WHIP SMUT SYMPTOM IN PLANT



# PATHOGEN



• *Ustilago scitaminea*

[Subdivision-Basidiomycotina,order-Ustilaginales,Family-Ustilaginaceae

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The fungal hyphae are primarily intercellular and produce tiny black **teliospores**.

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• The **thin** membrane which covers the smut whip represents the host epidermis.

- The smut spores are light brown in colour, spherical and echinulate.
- Smut spores germinate to produce 3-4 celled, hyaline promycelium and produce 3-4 sporidia which are hyaline and oval shaped with pointed ends.

## DISEASE CYCLE

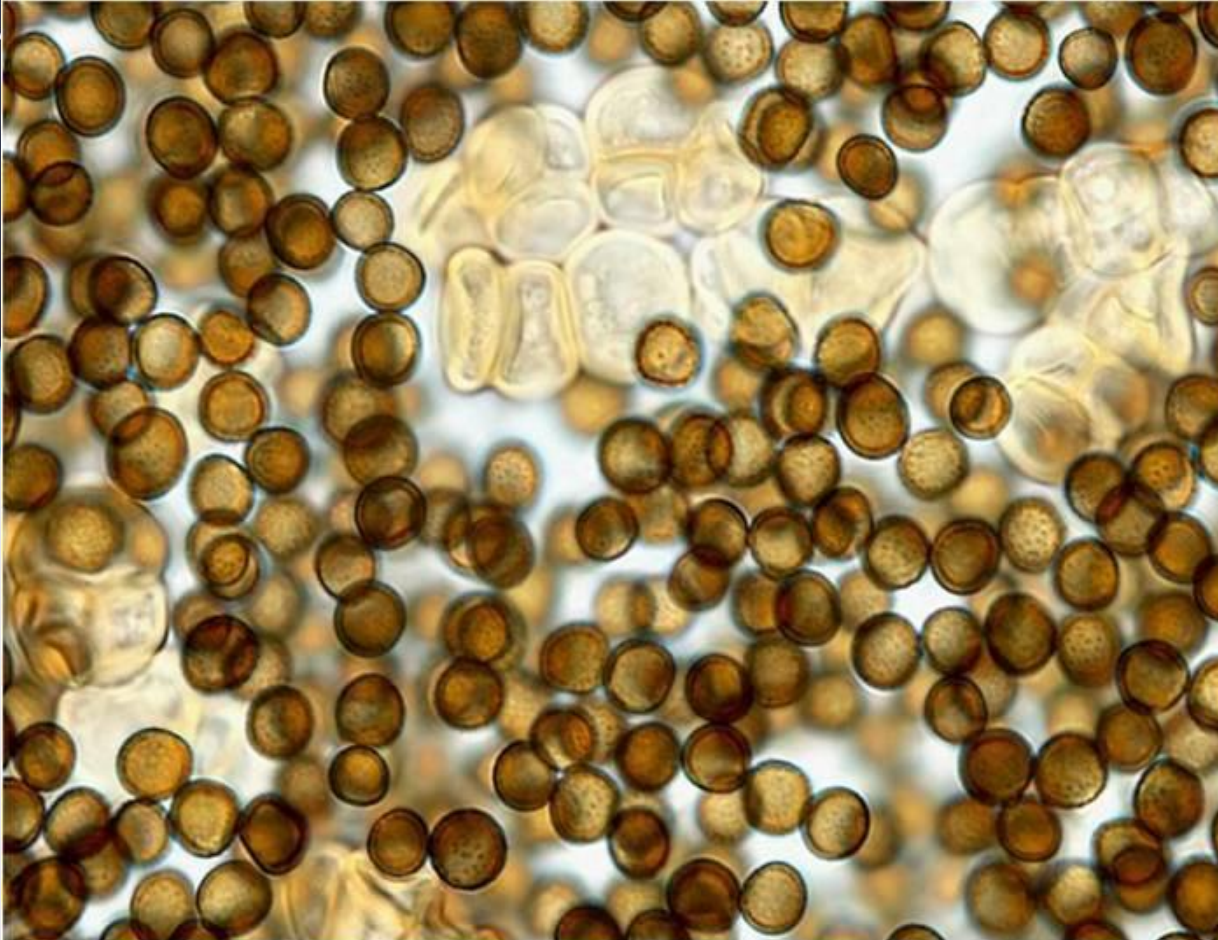
- Teliospores may survive in the soil for long periods, upto 10 years.
- The spores and sporidia are also present in the infected plant debris in the soil.
- The smut spores and dormant mycelium also present in or on the infected setts.
- The primary spread of the disease is through **diseased seed-pieces (setts)**.
- **In addition, sporidia and 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*.**



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# SMUT SPORE





## FAVOURABLE CONDITIONS

- Mono-culturing of sugarcane, continuous ratooning and dry weather during tillering stage favours the disease.

## MANAGEMENT

- Plant healthy setts taken from disease free area.
- Remove and destroy the smutted clump (Collect the whips in a thick cloth bag/polythene bag and immerse in boiling water for 1 hr to kill the spores).
- Discourage ratooning of the diseased crops having more than 10 per cent infection.
- Follow crop rotation with green manure crops or dry fallowing.
- Grow redgram as a companion crop between 2 rows of sugarcane.
- Treat the setts in hot water at 50°C for 2 hours.
- Grow resistant varieties like **Co 6806 an, Co 62175 ,Co449 etc.**



# WILT

## ECONOMIC IMPORTANCE

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• **The disease occurs singly or in combination with red rot.** The disease is more in wilt sick soils and in alkaline soils.

- Moisture stress aggravates the disease.

## SYMPTOMS

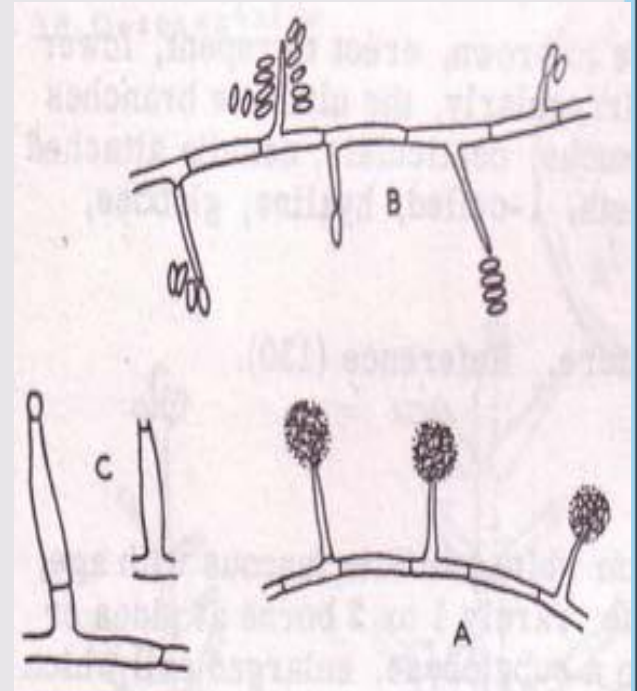
- The first symptom of the disease is visible in the canes of **4-5 months age**.
- **The canes may** wither in groups. The affected plants are **stunted with yellowing and withering of crown** leaves.
- The midribs of all leaves in a crown generally turn yellow, while the leaf lamina may remain green.
- The leaves dry up and stem develop **hollowness in the core or pith**.
- The pith shows **reddish discolouration with longitudinal red streaks passing from one internode to another**.
- In severe cases, spindle shaped cavities tapering towards the nodes develop in each internode.
- The canes emit a **disagreeable odour, with lot of white** mycelial threads of the fungus covering the cavity. Weight gets reduced due to hollow canes.





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# SYMPTOM AND CAUSAL ORGANISM





## PATHOGEN *Cephalosporium sacchari*

- The fungal mycelium is hyaline, septate and thin walled.
- The conidiophores are simple, slender or swollen on which hyaline, single celled, hyaline, oval to elliptical **microconidia**, which appear on **simple or branched, lateral or terminal hyphae**.
- **Macroconidia are not produced.** (This is the important character which differ it from **Fusarium sp.**)

### DISEASE CYCLE

- The fungus is primarily sett borne and also survives in the soil as saprophyte for 2-3 years.
- The disease is primarily transmitted through infected seed setts.
- The secondary spread is aided by wind, rain and irrigation water.

### FAVOURABLE CONDITIONS

- High day temperature (30-35°C), low humidity (50-60 per cent), low soil moisture, alkaline soils and excess doses of nitrogenous fertilizers.

### MANAGEMENT

- Select the seed material from the disease-free plots.
- Avoid the practice of ratooning in diseased fields.
- Burn the trash and stubbles in the field.
- Grow **coriander or mustard as a companion crop in the early stages of crop.**
- Avoid alkaline soils for growing the crop
- Treat the setts in hot water at 50°C for 2 hours followed by dipping in 0.05% Carbendazim for 15 minutes.
- Dip the setts in 40ppm **Boron or Manganese for 10 minutes**
- Grow resistant varieties like CO 617 and BP 17.



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# POKKAH BOENG OF SUGARCANE

- **Chlorotic phage**: The earliest symptom of pokkah boeng is a chlorotic condition towards the base of the young leaves lead to wrinkling, twisting, shorting and malformation of leaves. In the mature leaf, the irregular reddish stripes and specks are observed in chlorotic part.
- **Acute phage (top-rot phage)**: Red specks and stipe develop on young spindle and whole base of the young spindle rotton and dries up very fast and finally it formed a top rot of tender tissue of the apical part of the cane.
- **Knife cut phage**: This phage associated with acute phage. It is characterized by one or two or even more transeverse cuts in the rind the stalk/stem in such a uniform manner as if tissue are removed in sarf knife.



# SYMPTOM

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**Causal organism:** *Fusarium moniliformae*

**Sub-division:** *Deuteromycotina*

## **Disease cycle**

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**Primary infection:** This is an air-borne disease and primarily transmitted through the air-currents.

- **Secondary infection:** secondary transmission is through the infected setts, irrigation water, splashed rains and soil.

## **Favourable conditions**

- Cool and dry conditions favoured the survival of a fungus in plant debris.

## **Management**

- Spraying of 0.1% Carbendazim (1 gm/ lit. of water) or 0.2% Blitox-50 (2gm/ lit. of water) or Copper oxychloride or 0.3% Dithane M-45 (3gm/ lit. of water) are the most effective fungicides for reducing the pokkah boeng disease.
- Canes showing ‘top rot’ or ‘knife cut’ should be rogued out.



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# GRASSY SHOOT

## ECONOMIC IMPORTANCE

- In India the grassy shoot has become an important disease in TN, AP, Karnataka, Bihar and UP, next to red rot and smut.
- It is more severe in ratoon crops and reduces juice quality, plant height and cane yield drastically.

## SYMPTOMS

- The disease symptoms are usually seen two months after planting.
- The disease is characterized by the production of numerous lanky tillers from the base of the affected shoots.
- Leaves become pale yellow to completely chlorotic, thin and narrow.
- The plants appear bushy and 'grass like' due to reduction in the length of internodes, premature and continuous tillering.
- The affected clumps are stunted and in many instances exhibit premature proliferation of axillary buds.
- In a diseased clump one or two thin, weak and small canes are produced.
- In plant crop, young leaves of diseased plants are white (Albino) and the buds on such canes are usually white, papery and abnormally elongated.



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# GRASSY SHOOT SYMPTOM





## **PATHOGEN** *Phytoplasma*

- *Phytoplasma* is found in the sieve cells of infected plants.

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- Two types of bodies are noticed, spherical bodies of 300-400 nm diameter and filamentous bodies of 30-53 nm diameter.

## **DISEASE CYCLE**

- The pathogen is transmitted through planting material and within the crop by **aphids**, viz., *Aphis maidis*, *Rhopalosiphum maidis*, *Longiunguis sacchari*, *Melanaphis sacchari* and *M. indosacchari*.
- In addition, leaf hopper, *Proutista moesta* also involves in the transmission.
- **Sorghum serves as a natural collateral host.**

## **MANAGEMENT**

- Plant disease free setts.
- Remove and burn the infected clumps periodically.
- Avoid ratooning in problem areas
- Hot Water Treatment (HWT) of setts at 52°C for 30min or Aerated Steam Therapy (AST) at 50°C for 1 hr followed by steeping in fungicidal solution of carbendazim@0.05% for 15 minutes.
- Control vector by spraying Malathion or Dimethoate@2ml/lt.





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# RATTON STUNT OF SUGARCANE

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.

## Disease cycle

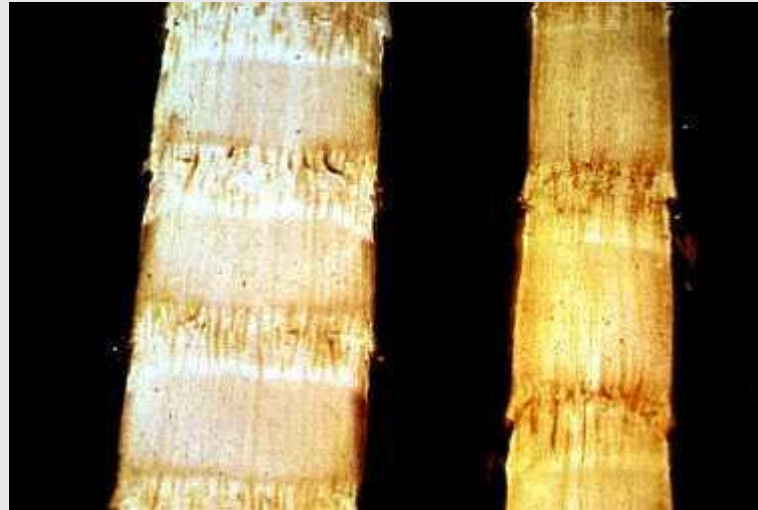
- **Primary infection:** The disease spreads through use of **diseased setts**.
- **Secondary infection:** Through cane harvesting implements contaminated with the juice of the diseased canes. **Maize, sorghum, Sudan grass** and ***Cynodon*** are some of the collateral hosts of the pathogen.



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**Causal organism: *Clavibacter xyli* pv. *xyli***  
**(Xylem limited fastidious bacteria)**





**Pathogen: Gram +ve, Fastidious, xylem inhabiting bacterium.**

## **Favourable conditions**

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High day temperature (30-35<sup>0</sup>C), low humidity (50-60 per cent), low soil moisture, alkaline soils and excess doses of nitrogenous fertilizers.

## **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<sup>0</sup>C for 8 hours or hot water treatment at 50<sup>0</sup>C for 2 hrs or aerated steam treatment at 50<sup>0</sup>C for 1 hour.