

BANANA

**DFHCM (2+1)
THEORY CLASS
5THSEM**

INTRODUCTION

- Banana (*Musa* sp.) is the second most important fruit crop in India next to mango.
- Banana evolved in the humid tropical regions of S.E.Asia with India as one of its centres of origin.
- It is referred as a kalapataru (that mean a plant of virtues).
- Main Banana producing states are Tamil Nadu, Maharashtra, Karnataka, Gujarat, Andhra Pradesh, Bihar, Assam and Madhya Pradesh.
- Important varieties of Banana are Dwarf Cavendish; Robusta; Rasthali; Poovan; Nendran; Red Banana; Karpurvalli; Pachanadan; Virupakshi etc.
- The area and production of banana in India is 830.5 thousand ha and 29779.9 thousand tonnes with an average yield of 35.9 mt/ha. (2010-2011)

MAJOR DISEASE OF BANANA

FUNGAL DISEASE

Sigatoka leaf spot	<i>Mycosphaerella musicola</i> (P. S.). <i>Cercospora musae</i> (I. S.).
Panama wilt	<i>Fusarium oxysporum</i> f. sp. <i>cubense</i> .
Anthracnose	<i>Gloeosporium musarum</i> .

BACTERIAL DISEASE

Moko disease / Bacterial wilt	<i>Ralstonia solanacearum</i> / <i>Pseudomonas solanacearum</i> / <i>Burkholderia solanacearum</i> .
Erwinia rhizome rot	<i>Erwinia caratovora</i> sub. sp. <i>caratovora</i> .

VIRAL DISEASE

Bunchy top / cabbage top /strangles disease	<i>Banana bunchy top virus</i> .
Banana Mosaic / Infectious chlorosis / Heart rot	<i>Cucumber mosaic virus</i> .

SIGATOKA LEAF SPOT

Causal Organism: Sigatoka leaf spot- *Mycosphaerella musicola*
(I.S: *Cercospora musae*)

ECONOMIC IMPORTANCE:

- First observed in Java in 1902.
- Epidemic in 1913 in plains of Sigatoka in FIJI Island.
- Wide spread in nature and occurs in many countries except in Egypt and Israel.
- In India it is severe in states of Assam, Tamil Nadu, Karnataka & A.P.
- Significant losses are caused by destruction of the foliage and reduction of the functional leaf surface of the plant.

SYMPTOM

- Early symptoms appear on the on young leaves.
- **Small spindle shaped spots appear on foliage with greyish centre they become enlarge in size becomes linear , oblong, brown to black spots with dark brown to black margin surrounded by yellowish halo running parallel to veins.**
- Spots are mostly seen along the edge of the leaf with defined margin and possess **dark brown to black margin.**
- Sever infection cause drying and defoliation of leave.
- On the upper surface of the spots, **fructifications of the fungus appear as black** specks on the leave.
- If the heavy infection occurs at the time of fruit maturation , the flesh ripens unevenly and individual bananas appear undersized and their flesh develops a buff pinkish colour, and store poorly.

SIGATOKA LEAF SPOT



ETIOLOGY

- The disease is caused by the fungus *Mycosphaerella musicola*, (Imperfect stage-*Cercospora musae*).
- Conidia are elongated, narrow and multiseptate.
- Perithecia are dark brown to black and asci are oblong, clavate.
- Bi-celled ascospores are produced which are septate, hyaline, obtuse with upper cells lightly broader.

EPIDEMIOLOGY

- High humidity, heavy dew and rainy weather with temp above 21 °C.
- Soils with poor drainage and low fertility favour the disease incidence.
- Thick planting, presence of weeds and increased number of suckers in a mat promote disease development.

SURVIVAL AND SPREAD

- Survives on dry infected leaves on the field soil and primary infection takes place through ascospores in the infected plant debris.
- Secondary spread through wind borne conidia and ascospores.
- Infection takes place through stomata on the lower surface of young leaves.
- Surface moisture is necessary for release of both conidia and ascospores. Hence the disease is severe in moist weather.

MANAGEMENT

- Removal and destruction of affected leaves followed by spraying with Bordeaux mixture (1%) +linseed oil (2%).
- Prevent water accumulation around the plant and go for periodical weeding.
- Spray Propiconazole+Carbendazim 0.1% or Chlorothalonil 0.25%. Wetting agent such as teepol or sandovit added at the rate of 1ml/lit of water.
- Spray zineb@0.25% or copper oxy chloride@0.3% suspended in mineral oil.

PANAMA WILT

CAUSAL ORGANISM :

Fusarium oxysporum f. sp. cubense.

ECONOMIC IMPORTANCE

- The first major disease which attacked banana was called Panama disease from the area where it first became serious.
- Panama wilt of banana was 1st discovered in Australia in the late 1880s but it reached epidemic proportions in the 1950s in Panama, where it destroyed 40,000 hectares of Gros Michel bananas and was then recognized as a devastating disease and a major threat to the banana industry in Central America.
- Severe on Rastali variety (Amrutapani), Gros Michel, Monthan Karpooravalli

SYMPTOMS

- Conspicuous symptoms usually appear on at least 5 months old banana plants. Symptoms initially seen in older plants in a mat and on older leaves.
- The earliest symptoms are faint yellow streaks on the petiole of oldest, lower most leaves.
- Affected leaves show progressive yellowing, break at the petiole and **hang down along the pseudostem.**
- Yellowing extends upwards and finally heartleaf alone remains green for sometime and it is also affected.
- Longitudinal splitting of pseudostem.
- **Discolouration of vascular vessels as red or brown streaks.**
- The fungus grows and blocks the vascular system resulting in wilting of the plant.
- **Affected plants give characteristic odour of rotten fish.**
- Roots of diseased rhizomes are frequently blackened and decayed

PANAMA WILT SYMPTOM



**WILTING SYMPTOM ON
WHOLE PLANT**



**LONGITUDNAL SPLITTING
ON STEM**



**BLACK COLOUR APPEARANCE
OF VASCULAR BUNDLE**

FAVOURABLE CONDITIONS

- Soil conditions like texture and structure, fertility level, temperature, drainage , cultural operation will greatly influence the disease incidence and spread in the field.
- Survival and growth of fungus are generally greater in acidic or light textured soils than in clay or alkaline soils with high calcium content.
- Saturated poorly drained soils have greater incidence.
- Insect injuries and wounds and infestation of burrowing nematode, *Radopholus similis*, predispose the disease

PATHOGEN

CAUSAL ORGANISM :

Fusarium oxysporum f. sp. cubense.

- The fungal hyphae are present in both inter- and intra- cellularly in the host tissue and confined to vascular bundles i.e. xylem vessels.
- The fungus produced three type of spore i.e micro-conidia, macro-conidia and chlamydospore.
- Microconidia-Single celled or rarely one septate, hyaline, elliptical or oval.
- Macroconidia-Sickle shaped hyaline,3-5septate and tapering at both ends.
- Chlamydospores-Thickwalled, spherical to oval, hyaline to slightly yellowish in colour.

SURVIVAL AND SPREAD

- Survive as chlamydospores in soil or in infected rhizomes.
- Spread as conidia through irrigation water or through root contact.

MANAGEMENT

- Use of disease free suckers for planting.
- Avoid ill drained soils, and prefer slightly alkaline soils (7-7.5 pH) for cultivation.
- Flood fallowing for 6 to 24 months or crop rotation with rice.
- Application of lime (1-2 kg/pit) to the infected pits after chopping of the plants parts.
- Dipping of suckers in carbendazim (0.1%) solution before planting.
- Soil drench with 0.1% carbendazim or 0.01% Vapam.
- Growing resistant Cavendish varieties, viz., **Basrai (Vamanakeli)**, **Poovan** (Karpura chakkarakeli), **Moongil**.
- Dwarf varieties are generally resistant.

ANTHRACNOSE

CAUSAL ORGANISM : *Gloeosporium musarum*.

SYMPTOM

- The skin at the distal ends of the fingers turn black .
- The fungus produces masses of conidia which form a pinkish coat .
- The entire fruit, stalk and buds are affected .
- The bunch becomes black.
- Fruits get shrivelled .

ANTHRACNOSE



SURVIVAL

- Optimum temperature for disease development 30-35°C and relative humidity of above 85%
- The incidence was severe during June-September when the temperature was high

MANAGEMENT

- Spraying copper-oxychloride 0.25% or Bordeaux mixture 1%.

MOKO DISEASE / BACTERIAL WILT OF BANANA

- CAUSAL ORGANISIM:

Ralstonia solanacearum

(Pseudomonas or Burkholderia)

ECONOMIC IMPORTANCE:

- The Moko disease of banana occurs through out the tropical western hemisphere where bananas are grown.
- First recorded in Guyana in 1840 .
- In India, first reported from West Bengal in 1968.
- The disease prevalent in Kerela and Tamilnadu affecting the introduced cavendish banana variety ,meant for export.

MOKO DISEASE



CONT....



SYMPTOMS

- Symptoms start on rapidly growing young plants.
- The Youngest three to four leaves turn pale green or yellow and collapse near the junction of lamina and petiole.
- Characteristic discoloration of vascular strands, wilting and blackening of suckers.
- The discolouration is in the central portion of the corm.
- When the pseudostem is cut transversely greyish brown bacterial ooze can be seen.
- A firm brown dry rot is found within fruits of infected plants (characteristic symptom).

PATHOGEN

- Moko disease is caused by *Ralstonia solanacearum*.
- Cells of bacterium are rod shaped and motile.
- It has 1-4 flagella.
- They are Gram negative.

DISEASE CYCLE

- P.I: Through diseased plant suckers used for planting.
- S.I: Through irrigation water, implements and by insects.

MANAGEMENT

- Grow resistant varieties like **poovan and monthan**.
- Adopt strict plant quarantine and phytosanitary measures.
- Use of healthy planting material.
- Exposure of soil to sunlight during dry hot weather.
- Eradicate infected plants and suckers killing *in situ* by application of herbicides.
- Disinfestation of tools with formaldehyde diluted with water in 1:3 ratio.
- Crop rotation (3 years rotation with sugarcane or rice) & providing good drainage
- Allow fallow period or flooding during off-season
- Fumigation of infected site with Methyl Bromide or chloropicrin.
- Spray systemic insecticide to prevent transmission of disease to healthy plants.
- Biocontrol with *Pseudomonas fluorescens*.

BUNCHY TOP OF BANANA

- **Also known as Curly top / cabbage top /strangles disease.**

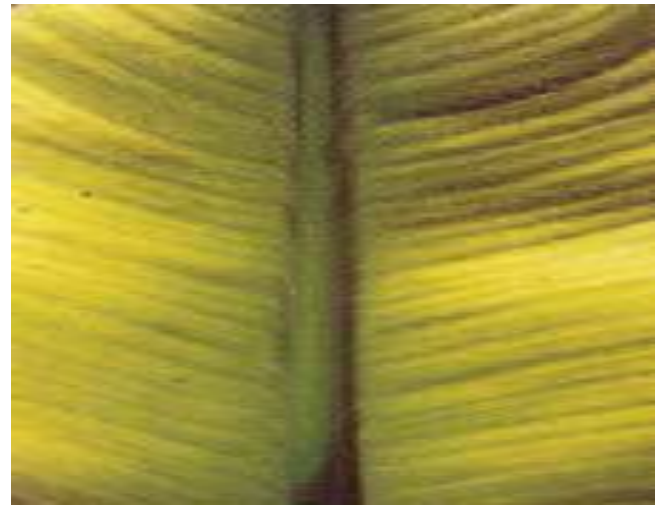
Economic importance

- First reported from Fiji in 1879 in Cavendish varieties
- Around 1940, introduced into **India from Srilanka through cyclone.**First appear in kerela.
- **It is present in Tamilnadu,karnataka,Andhra,Orissa,Bihar and Assam.**

SYMPTOMS

- Prominent dark green streaks on the petioles and midrib along the leaf veins
- Green streaks range from a series of dark green dots to a continuous dark green line (**Morse code**).
- Marginal chlorosis and curling of leaves.
- Petioles fail to elongate.
- Leaves are reduced in size, chlorotic, stand upright and become brittle and are
- **crowded at the top (Bunchy top)** and show dark green streaks with '**J hook**' shape near the midrib.
- Flowers display mottled and streaked discolouration.
- Plants show marked stunting.

BUNCHY TOP OF BANANA



**BUNCHY TOP APPEARANCE ON THE TIP
OF PLANT**



CONT.....

- **PATHOGEN: Banana bunchy top virus is a ss DNA virus with single isometric particles**

DISEASE CYCLE

- P. I. Through infected plant suckers.
- S. I. By Banana aphid, *Pentalonia nigronervosa*.
- Reservoir hosts: *Cucumis sativus*, *C. melo*, *Catharanthus roseus*, *Gynura aurantiaca*, *Colocasia esculenta*, *Amomum subulatum* and *Elettaria cardamom*.

MANAGEMENT

- Adaptation of strict quarantine measures.
- Eradication of all infected suckers by spraying with kerosene or by injecting herbicide, 2, 4-D.
- Use of only certified banana suckers for planting.
- The new crop should be regularly inspected and the diseased plants destroyed as soon as noticed.
- Vector control with systemic insecticides, *Viz.*, *Phosphomidon @ 1ml/lt* or *Methyl demeton @ 2 ml/lt*