DISEASE MANAGEMENT OF CROP AND HORTICULTURE PLANT

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Important Diseases

01 **Coffee:**

02 **Corn Disease:** *Anthracnose & Common smut*

03 **Banana: Panama & Blood disease**

04 **Mango Disease:** *Anthracnose, powdery mildew and* **Verticilium wilt.**

05 **Cacao Disease:** *Cocoa pod rot disease*

1. Coffe disease

1.1. Leaf rust Disease

1. 2. Root disease (Meloidogyne incognita)

1.1. Leaf rust Disease

Leaf rust is a major disease in coffee plants worldwide. This disease was discovered during an outbreak of attacks that damaged coffee plants in Sri Lanka, India and Indonesia in the 1460s (Prakash et al., 2014). This disease generally attacks arabica coffee, but also liberica and robusta.
Robusta coffee is resistant to leaf rust attacks but is not immune so it can still be attacked.

caused by the fungus Hemileia vastatrix B et Br. This disease is the most important in Arabica coffee. Pathogens are not only annoying plant growth, too cause loss of good quality results as well as quantity.

More leaf rust disease attack Arabica coffee compared to Robusta (Hulupi, 1998; Sri-Sukamto, 1998) because the Robusta type has a level of higher resistance to pathogens H. vastatrix (Semangun, 2000).

The existence of this leaf rust disease has causing loss of yield on all coffee producing countries in Asia and Africa (Agrios, 2005).

Symptoms

Symptoms of leaf rust disease can be seen on the upper and lower surfaces of the leaves, marked with yellow-orange spots like powder (powder).
Infected leaves appear yellow spots (Figure 1b) then change turn brown.
If observed in section the underside of the leaves looks spotty at first light yellow, then change becomes dark yellow, in that part it will be the orange flour is clearly visible or orange (Fig. 1c).
The flour is the uredospore of the fungus H. vastatrix.
Symptom further on the leaves appear brown spots with each other join, become bigger, then dry (Fig. 1d), and fall off.
By overall leaf rust infection coffee plants cause many leaves fall, then the plant will be bare thereby reducing production. Such that described by Brown et al. (1995),

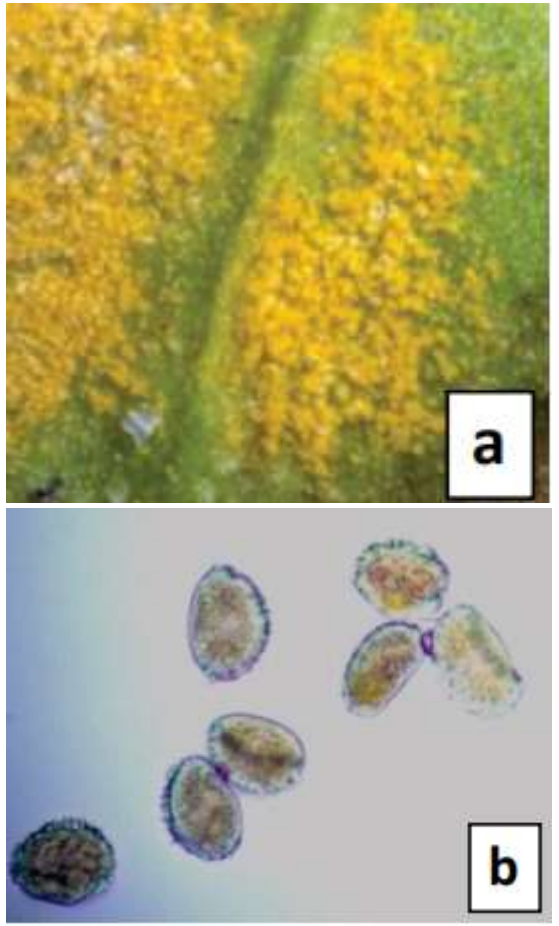
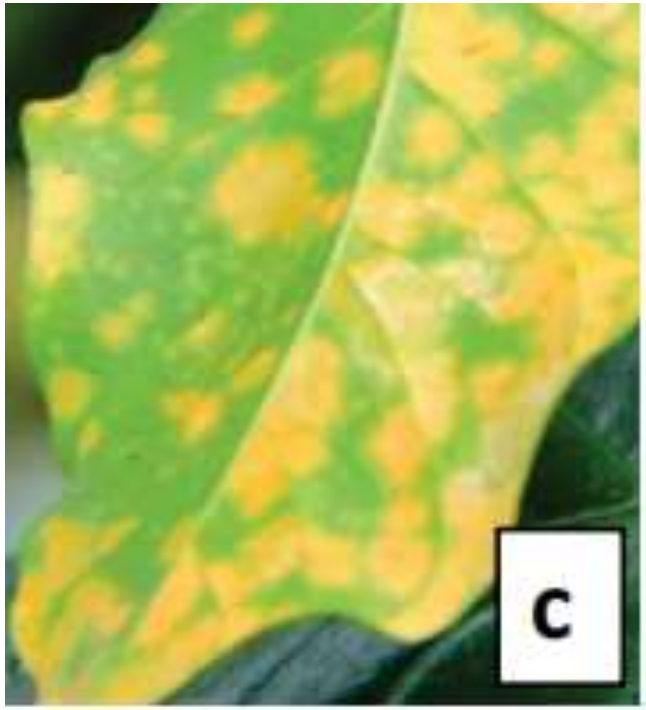


Figure 2. Morphology of H. vastatrix uredospores: a) macroscopic and b) microscopic

Symptoms of H. vastatrix fungus attack on coffee plants

a) coffee plants are attacked by leaf rust

b) symptoms of H. vastatrix on the upper surface of the leaf



c) the lower surface leaves

d) advanced symptoms

Bioekology

Vulnerability to infection and development of leaf rust influenced by plant age and leaf density. Young leaves are more sensitive against leaf rust disease compared to older leaves, but younger leaves not fully open yet very resistant against infection (Semangun, 2000). the leaves touching each other will make it easier disease progression. Besides that too can increase the humidity of the environment which trigger infection and development of H. vastatrix (Brown et al., 1995).

Other factors that can affect disease progression is the environment, i.e. temperature, humidity air, rain and sunshine (McCartney, 1994; Brown et al., 1995). Temperature in above 15 °C around the coffee plant can inhibit disease progression (Brown et al., 1995). Meanwhile, rain plays a role in increasing humidity so that suitable for uredospore germination and spread of the fungus H. vastatrix.
Sunlight directly touching the leaf surface. inhibit the germination process uredospores and prolong the period incubation of leaf rust (McCartney, 1994).

This is the key word in efforts to prevent and control this disease!

Control

Leaf rust control recommended is the use of resistant varieties, technical culture, chemical fungicides (synthetic), use of biological agents and vegetable fungicides (Sri-Sukamto, 1998; Wiryadiputra et al., 2002). If infection leaf rust in the moderate to heavy category then possible control with resistant varieties, chemical fungicides and technical culture.

Application of IPM packages such as implementation of technical culture and control pests and diseases, reported to be effective suppress leaf rust disease, performance Arabica coffee plants are more robust and fertile, and can increase the production of coffee beans wet 2.88 times higher than farmers' treatment (Rosmahani et al., 2005).

1. Resistant varieties
Arabica coffee plant assembly a lot has been done to get leaf rust resistant varieties productive and of high quality.
Planting varieties are also different levels resistance when planted at a height different varieties, for example coffee varieties Arabica S795 has resistance to leaf rust disease when planted on altitude of more than 1000 m above sea level (above sea level) or less than 900 m asl (Table 1).

Table 1. The resistance level of Arabica coffee varieties against leaf rust

No.	Varieties	Altitude place (m asl)	Level endurance
1	Kartika 1	> 1000 and < 900	Vulnerable
2	Kartika 2	> 1000	Somewhat vulnerable
		< 900	Susceptible
3	Abesinia 3	> 1000 and < 900	Vulnerable
4	S795	> 1000	resistant
		< 900	Somewhat resistant
5	USDA 762	> 1000 and < 900	Somewhat resistant
6	Andungsari 1	> 1000	Vulnerable
7.	S1934		resistant
8.	BLP 10		resistant
9.	BP 416 A		resistant

Source: Prastowo et al. (2010)

2. Technical Culture

Controlling the technical culture that recommended by Puslitkoka is weeding, fertilizing, pruning and shade management (Puslitkoka, 1998). Control with technical culture if done right can reduce the intensity of rust attack leaf.

3. Chemical

Control with chemical fungicides has so far been the mainstay of farmers to control leaf rust disease. Fungicide spraying can be carried out on the affected areas, namely: taking into account the Early Warning System and evaluated every 0.5–1 month (Prastowo et al. (2010).

In Brazil, de Souza et al. (2011) suggested that in managing coffee plantations all leaf rust control strategies can be applied including systemic fungicides. Spraying of systemic fungicides with active ingredient epoxiconazole on plants is carried out on the specified date or after confirming a disease incidence of 10%. Fungicides used for leaf rust control with active copper ingredients, such as copper oxide, copper chloride, copper hydroxide or copper sulfate made from bordo slurry (Rivillas et al., 1999).

Copper is effective in controlling coffee leaf rust, however the application is better before the occurrence of infection on the leaves or called preventive measures.

The impact of using this fungicide if excessive it will cause accumulates in the soil, especially in organic matter, can poison plants and other organisms in the environment (Arneson, 2000)

4. Plant-based fungicides

The use of plant material as a vegetable fungicide is another alternative to control leaf rust disease.

1. Bordo slurry solution is proven to suppress leaf rust infection in the same way as the use of chemical fungicides (synthetic) with the active ingredient copper hydroxide (Rosmahani et al., 1999).
2. Mahogany seed extract solution with a concentration of 0.1–0.2% was effective in suppressing leaf rust disease.
3. extracts of ginger rhizome, turmeric rhizome, clove leaf and betel leaf can reduce the percentage of uredospore germination (Ginting, 2006).

5. biological control

Potential biological agents Pseudomonas reported that the agents
The biological activity of the bacteria Bacillus subtilis and Pseudomonas fluorescens can reduce the incidence of coffee leaf rust disease up to 26.45% (Daivasikamani and Rajanaika (2009). Pseudomonas sp. isolate B157, it is known that this fungus can reduce rust intensity as effectively as copper hydroxide (Haddad et al. (2009).).
B157 isolate is a potential biocontrol for coffee rust control in organic crop systems in Brazil.

In Mexico, a survey conducted by Carrion and Rico-Gray (2002) showed that in coffee plantations, fungi that have the potential as biological agents of H. vastatrix and are mycoparasites, namely Acremonium byssoides, Calcarisporium arbuscula, C. ovalisporum, Sporothrix guttuliformis, Fusarium pallidoroserum and V. lecanii.

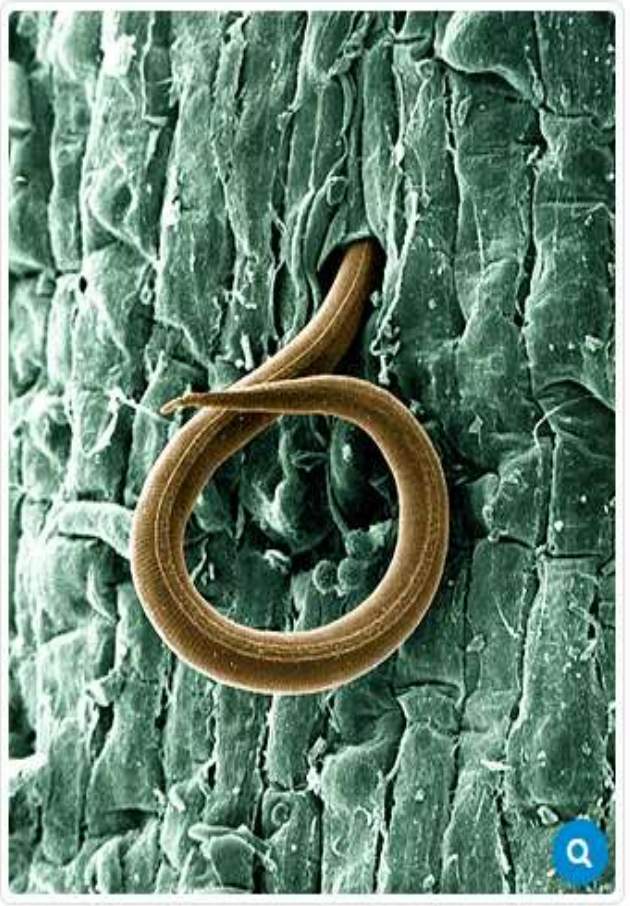
1. 2. Root disease (Meloidogyne incognita)

Nematode attack can affect the process of photosynthesis and transpiration and plant nutrient status (Melakeberhan et al., 1987).

As a result, plant growth is inhibited, the color of the leaves is yellow chlorosis and eventually the plant dies.

In addition, nematode attacks can make plants more susceptible to pathogens or other pests such as fungi, bacteria and viruses.

As a result of nematode attack can inhibit plant growth, reduce productivity, and production quality (Mustika, 2005).



***Meloidogyne incognita*- a plant parasite**

Magnified 500x, in the process of penetrating a tomato root. The worm will establish a feeding site once inside, which causes

1. 2. Root disease (Meloidogyne incognita)

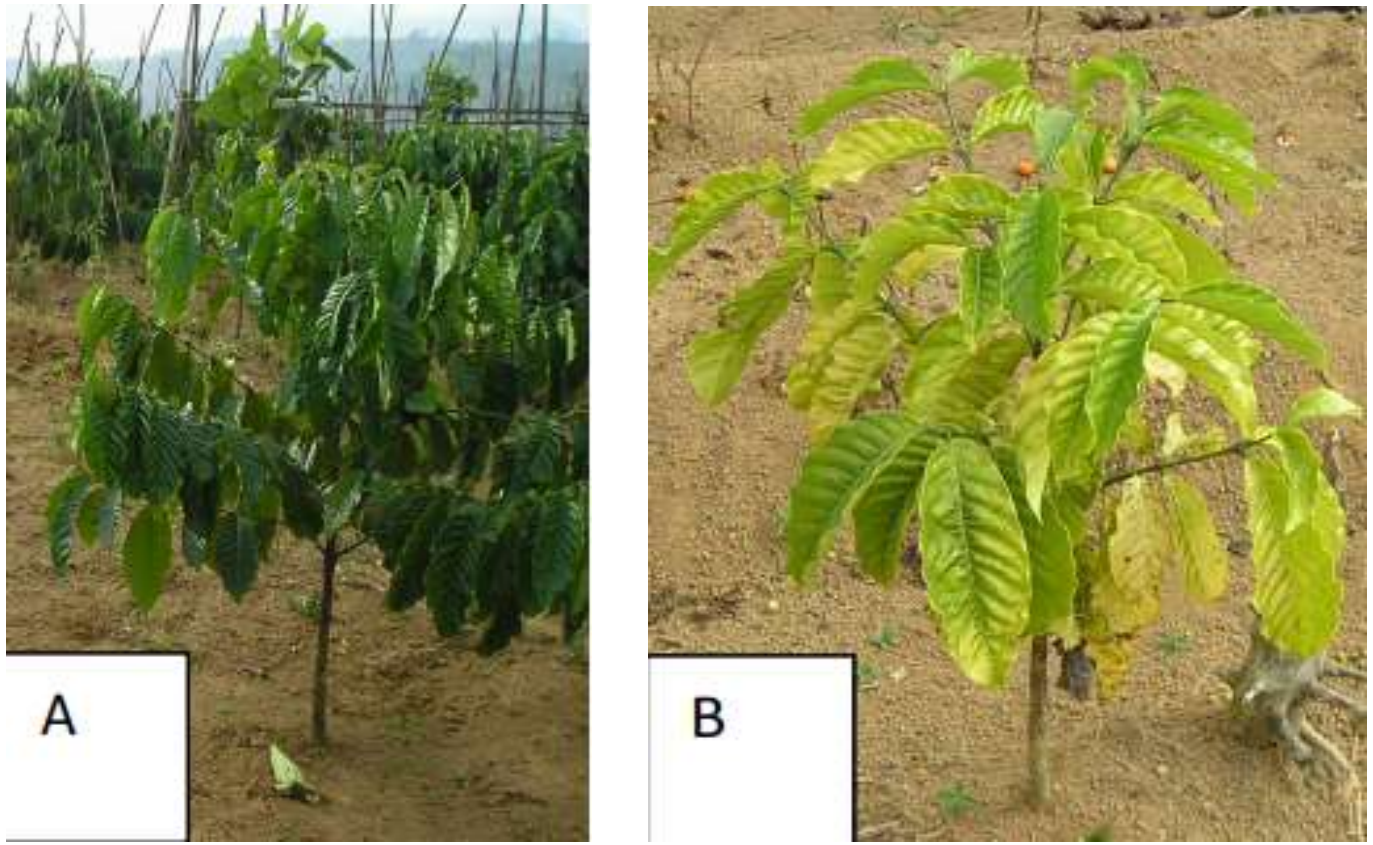
Meloidogyne incognita is the most common plant parasitic nematode species and the most common nematode in tropical and subtropical regions. Several plantation crops, such as ginger, kenaf, coffee, pepper, patchouli, cloves, sugar cane, tea, tobacco, galangal, temulawak, and cardamom were not spared from the attack of the nematode Meloidogyne incognita (Mustika, 2005).

This nematode is a nematode that develops very quickly and has a high compressive power to plant growth with characteristic symptoms seen in the roots, namely in the form of nodules called root clefts (Whitehead, 1998).

Gall or purulent formation due to nematode infection causes the roots to experience hypertrophy and hyperplasia, namely swelling of plant root tissue as well as cell division and excessive cell enlargement in plant pericycle tissue (Shipton, 1997 in Istiqomah, 2015).

1. 2. Root disease (Meloidogyne incognita)

In addition to the formation of galls or puru in the root system, the affected plants Meloidogyne incognita leaves experiencing chlorosis, stunted plants, leaves experience chlorosis, wilt and many fall, stunted plants, fewer roots, and if the plants are severely or severely attacked, the affected plants will die (Taylor and Sasser, 1978).



Kopi umur 2 tahun (A = normal, B = sakit)

nematode attack can cause slow growth, yellowing leaves, leaves and flowers fall, coffee production decreases. More severe attacks can cause the plant to die.
In general, plants that are attacked by nematodes easily wilt during the day especially in the dry season.

In Costa Rica, the attack of root-knot nematodes causes plants to weaken and causes a decrease in coffee production of about 10-20% (Bertrand et al., 1997 in Campos and Villain, 2005).
Meanwhile, in Indonesia, P. coffeae attacks are reported to cause losses, reducing production by around 30-80% (Wiryadiputra, 1995).

Control Meloidogyne incognita)

1. Chemis

Nematicides consist of fumigant nematicides and granular nematicides systemic. The most widely used fumigant is methyl bromide (this fumigant will be prohibited from using because it can damage ozone), while granular nematicides that are widely used are those with active carbamates and organophosphates.

2. technical cukture

Grafting and planting of nematode-resistant coffee plants. Many farmers who graft coffee use staple crops that are resistant or tolerant to nematode attacks. Another effort is to plant coffee plants that are more resistant to nematode attacks, such as robusta coffee.

In general, nematode problems arise on land that is not fertile. Therefore, the management of organic matter inputs must be considered. The input of organic matter in sufficient quantity and quality, in addition to improving soil fertility, will also increase the role of natural enemies of nematodes.

Control Meloidogyne incognita)

3.Biological control.
Several types of bacteria and fungi act as natural enemies of nematodes, namely as parasites and nematode predators. The application of natural enemies can reduce nematode populations in the field.

The planting of kenikir as a meloidogyne repellent plant alternately followed the line of coffee plants. Kenikir (Cosmos) is a tropical plant belonging to the Asteraceae tribe originating from Latin America and Central America, but grows wild and is easily found in Florida, the United States, and in Southeast Asian and South Asian countries. The roots of kenikir produce exudate which parasitic nematodes do not like.




2. Maize (Corn)

2.1. **Anthracnose** (*Colletotrichum graminicola*)

2.2. Common smut (Boil smut, Blister smut) Ustilago zeae

2. Maize (Corn)

2.1. Anthracnose (*Colletotrichum graminicola*)

Symptoms

Anthracnose lesions on maize leaves

Anthracnose lesion on maize leaf

Stalk rot symptom due to anthracnose disease (Colletotrichum graminicola)

2. Maize (Corn)

2.1. Anthracnose (*Colletotrichum graminicola*)

Symptoms

Anthracnose symptoms vary widely depending on numerous factors such as genotype, age of plant and environmental conditions.
- Small oval or elongated water-soaked spots which enlarge up to 15 mm
  long appear on leaves
- Lesions develop a tan center and red-brown or orange border
- Lesions may coalesce to form large necrotic(dead) patches
- Severely infected leaves on susceptible hybrids may wither and die
- Fungal fruiting bodies develop on dead tissues and may produce pink or orange spore masses
- Top dieback and stalk rot

Anthracnose leaf blight on maize

2.1. Anthracnose (*Colletotrichum graminicola*)

- ✓ Fungus survives the winter on crop debris.
- ✓ Emergence of disease is favored by high temperatures and extended periods of wet and cloudy weather.
- ✓ seedlings and mature plants are most susceptible to the disease.

Management:

- rotating crops and plowing crop debris into soil may help reduce incidence of early season infections;
- spraying with liquid smoke mixed with aloe vera extract can suppress the development and spread of pathogens.

2.2. Common smut (Boil smut, Blister smut) Ustilago zeae

Smut galls on corn tassels

Signs and symptoms of common smut (Ustilago maydis) on a corn plant.

Common smut on sweet corn cv. White Delight

2. Maize (Corn)

2.2. Common smut (Boil smut, Blister smut) Ustilago zeae

Symptoms:

- ✓ Tumor-like galls on plant tissues which are initially green-white or silvery white in color;
- ✓ interior of galls darken and turn into masses of powdery dark brown or black spores (with the exception of galls on leaves which remain greenish in color);
- ✓ galls may reach up to 15 cm in diameter and are common on ears, tassels, shoots or midrib of leaves; galls on leaves remain small and do not burst open

- ➢ Fungus overwinters on crop debris or in the soil and can survive for several years;
- ➢ fungus usually enters the plant through wounds;
- ➢ application of nitrogen fertilizer increases incidence of disease, while application of phosphorous fertilizer decreases infection.

2. Maize (Corn)

2.2. Common smut (Boil smut, Blister smut) Ustilago zeae

Management:

- ✓ Although many practices may be recommended for the control of common smut, the only method that is completely effective is to grow resistant corn hybrids.

- ✓ Meanwhile, to control it, spraying of fungicides is recommended, it is recommended that several fungicides with active ingredients Isoprothiolane + fenoxanil for example Kamikaze 371 EC 100 ml with application for 10 tanks

3. Banana diseases

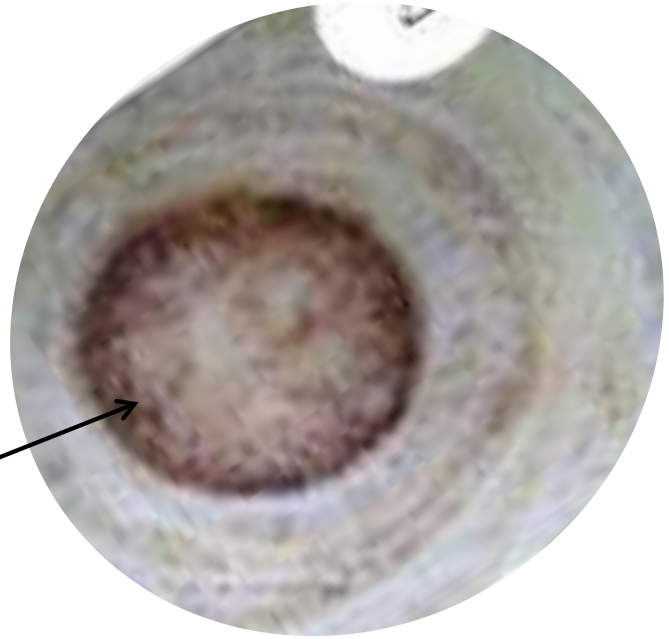
3.1. Panama Disease

3.2. Blood Disease Bakteria

3. Banana Disease

3.1. Panama Disease

3.2. Blood Disease Bakteria



Symptoms

3.1. Panama disease

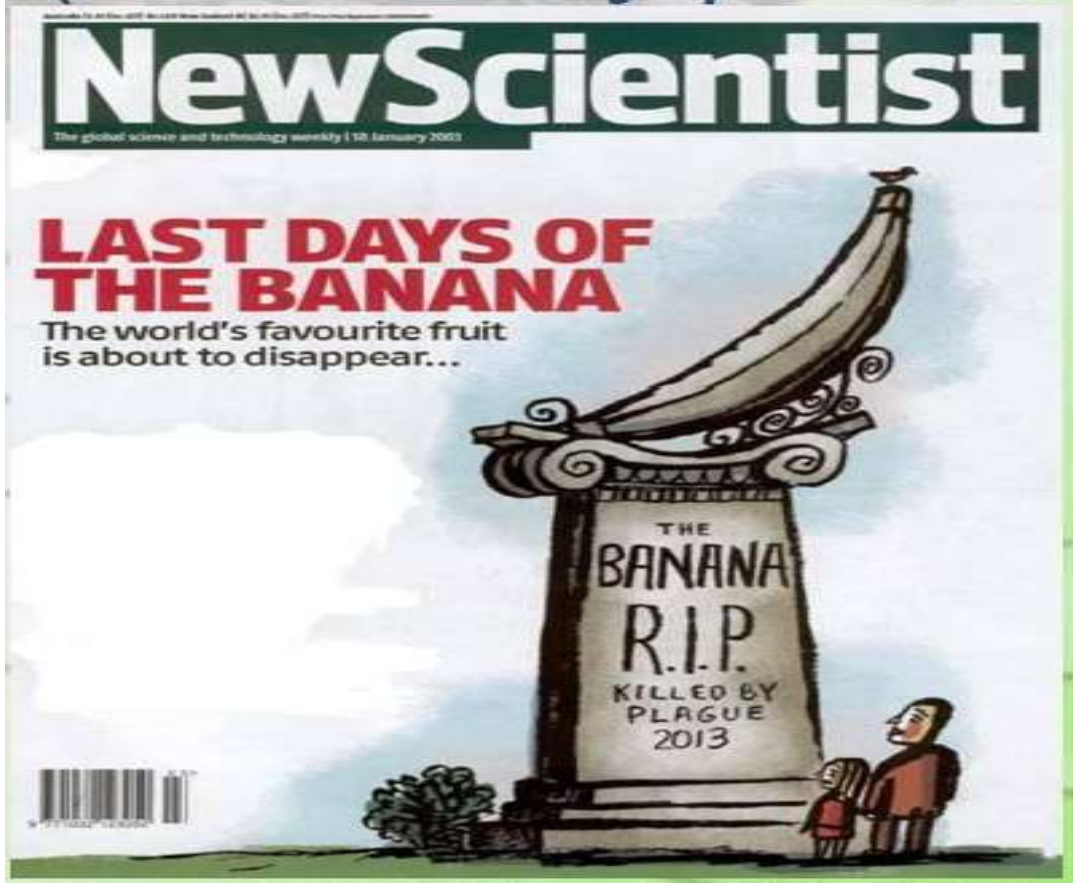
(*Fusarium oxysporum* f.sp. *cubense*)

Symptoms

Attack data Fusarium wilt

LAYU FUSARIUM/ PANAMA
(*Fusarium oxysporum* f.sp. *cubense*)

KENDALA UTAMA



- 1990-1960 : 40.000 Ha Gros michel (Amerika Selatan)
- 1986 : Cavendish (Taiwan)
- 1995 : 1000 Ha Cavendish (Halmahera)
- 1992-1997 : 1300 Ha Barangan (Sumut)
- 1992-1995 : 300 Ha Cavendish (Riau)
- 1995-2000 : 1700 Ha Cavendish (NTF Lampung)
- s/d 2010 : NAD - Papua

symptoms
Fusarium wilt

Ecobiology

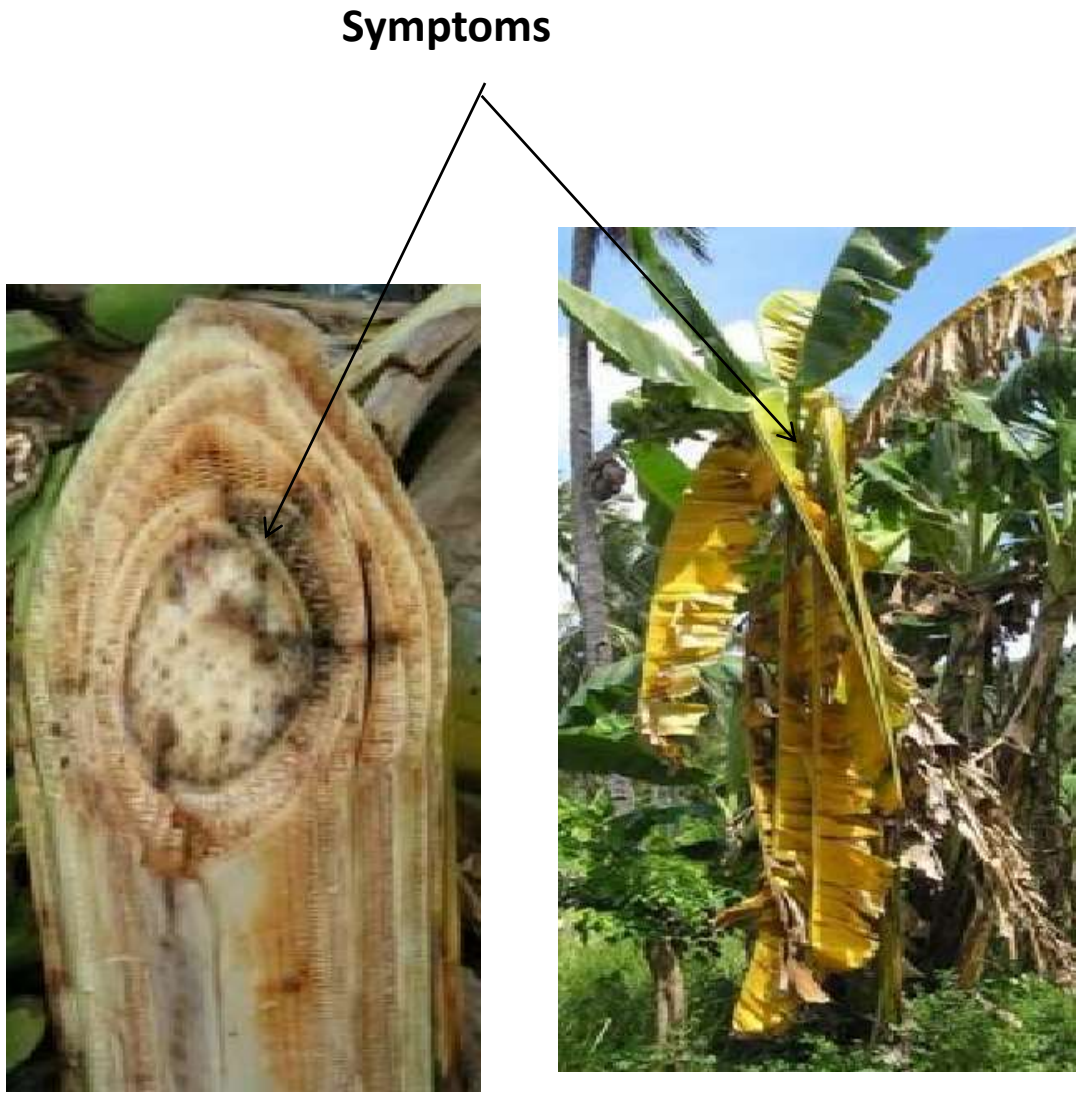
- Gardens with light shade are less susceptible to disease disturbances. Foc fungi can also survive a long time in the soil (30 years).
- Soil that has been infected is difficult to recover from this fungus.
- As primary pathogens, fungi can infect host tissue before other pathogenic fungi attack and can cause symptoms.
- As a secondary pathogen when the fungus infects the host plant after another fungal pathogen attack, so that the attack rate becomes so severe [Joffe, (1973) in Isnaini, et al. (2004)].

- Types of bananas affected:
- The Ambon banana varieties, Cavendish, Raja Bulu are very susceptible.

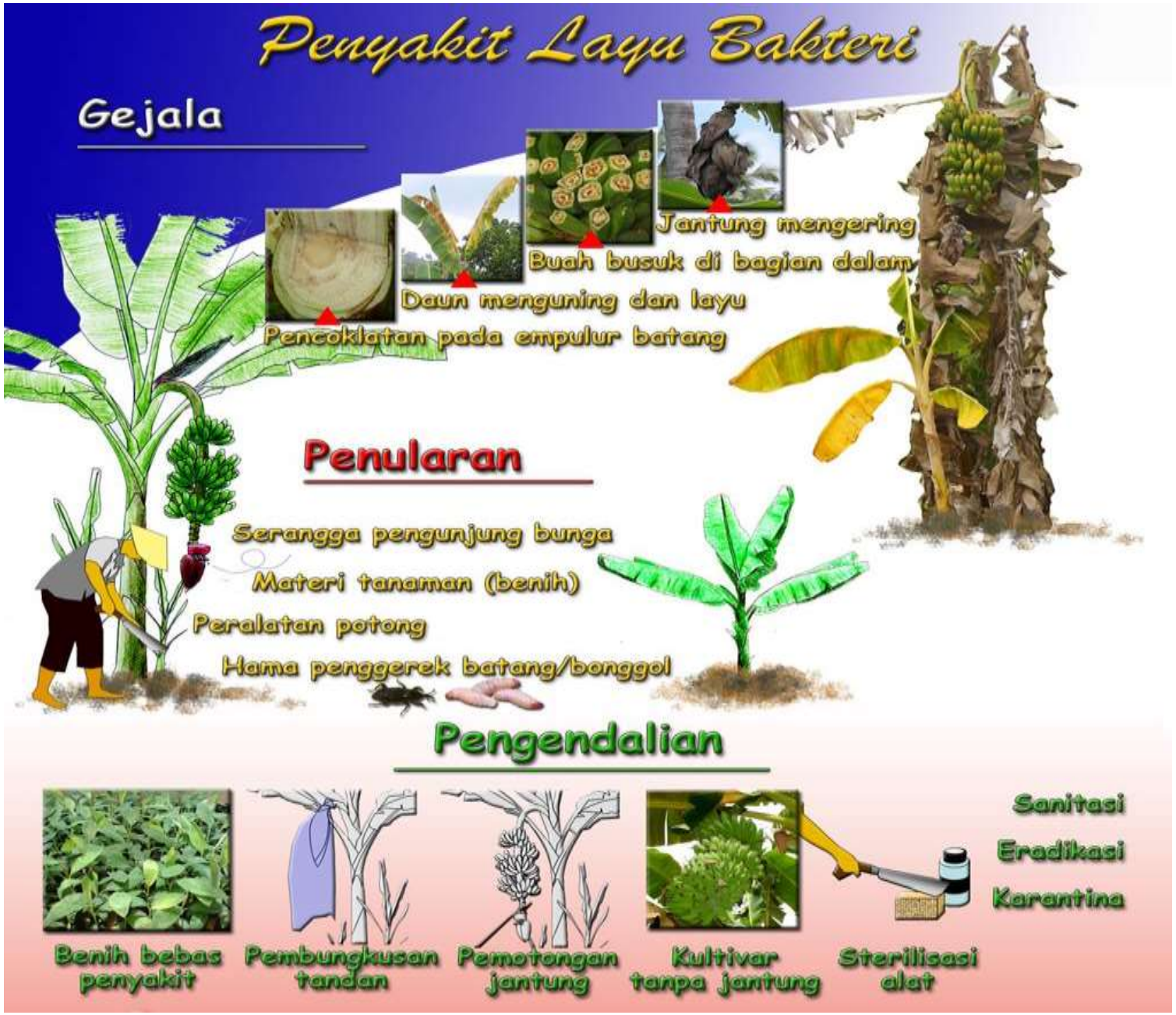
Ecobiology

3.2. Blood Disease Bacteria (Pseudomonas solanacearum)

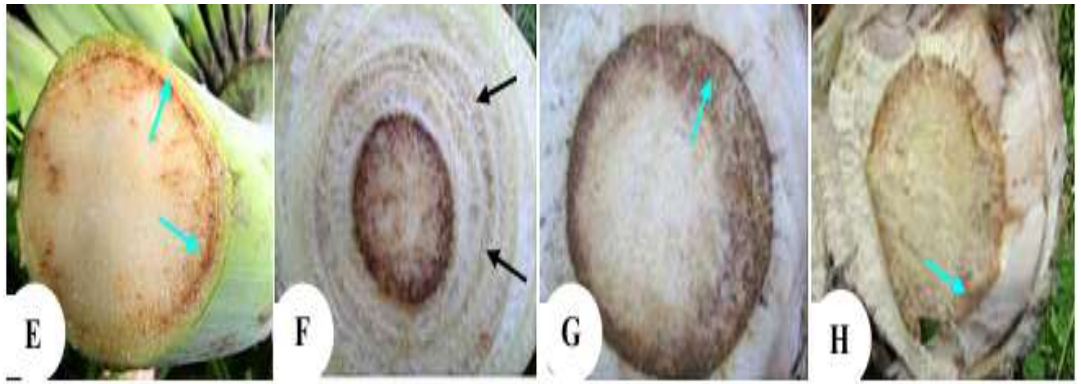
- The bacteria survive on diseased plant debris.
- The only host is banana n Heliconia. The Ambon n Raja banana is vulnerable, the horn stick is rather resistant
- Low saprophytic power
- Contagious via sick seeds, cutting tools, hoes and flower pollinators.
- Nematode infestation can be an entry point for bacteria.



3.2. Blood Disease Bacteria (Pseudomonas solanacearum)



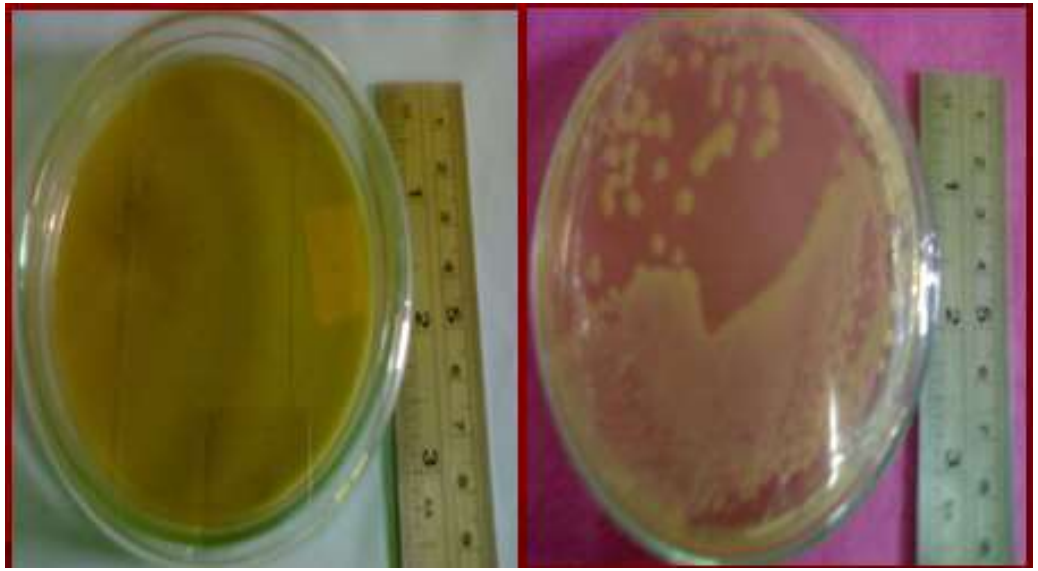
Symptoms



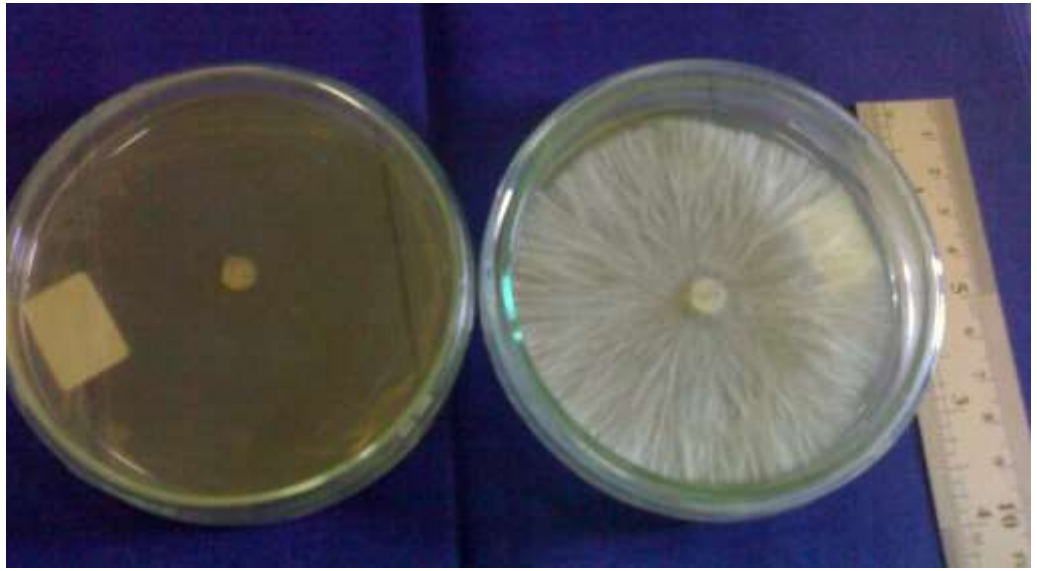
- The leaves appear yellow, starting from the youngest leaves, the midribs, then they break and get closer to the pseudo-stem.
- When the stump or pseudo-stem is split, a white to red discharge will appear (bloody banana disease /BDB).
- If the stem is still healthy but the fruit is rotten, it means that the infection occurred through the flower / fruit.

In Vitro Research Results

Eugenol against Pseudomonas
3 days after inoculation



Eugenol against Fusarium
7 **days after inoculation**



at a dose of 0.5%, fungi & bacteria do not grow at all

Eugenol-producing plants

Eugenia aromatica

Pogostemon cablin Benth.

Cympogon nardus

Eugenol-producing plants

Myristica fragrans

Cananga odorata

Cinnamomum zeylanicum

Eugenol-producing plants

Ocimum spp.

Cananga odorata

Zingiber officinale

Control

1. SOAKING THE SEEDS

A. SEEDLINGS AGED 4 MONTHS FROM TISSUE CULTURE

B. SOAKED FOR ± 15 MINUTES.

C. IT IS PLANTED IN A HOLE MEASURING 25X25X25 CM WHICH HAS BEEN PREPARED 2 WEEKS BEFOREHAND.

D. PLANT HOLES ENRICHED WITH MANURE / ORGANIC.

E. WATERING THE YOUNG PLANTS EVERY EVENING 3 TIMES A WEEK.

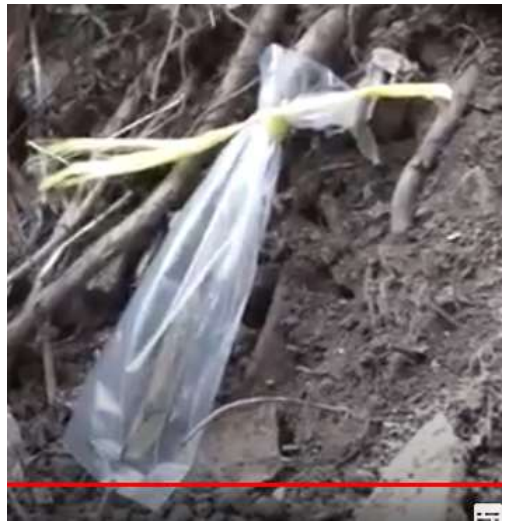
2. Root Infusion

A. Prepare a 12 ml syringe and a plastic sheet of ice cream

B. Choose a light brown root, then split it obliquely, the position of the roots forms 450C. Cut the roots at an angle so that the surface that will absorb the drug is wider.

C. Insert the roots into the plastic, the tip of the roots touching the bottom of the plastic so that all the solution is absorbed.

D. Tie the plastic with a rope, then put the extract solution into the plastic.



C

Control (Root Infusion)

e. Be careful not to change the position of the roots, then cover them with soil or litter.

F. Observe four days after treatment, if the solution is still remaining then look for other roots.

control

3. Injection Rod (https://youtu.be/1o5IrnkWycQ)

a. The extract solution is soaked for 1 night
b. Prepare a 12 ml syringe.
c. Inject the solution slowly at a 45 degree position.
d. The injection site is about 25 cm from the ground....

4. Potato disease

1. Potato leaf rot

Phytophthora infestans

- ✓ Pathogens are transmitted through air and water....
- ✓ Early symptoms are wet spots on the edges or middle of the leaves.
- ✓ The spots then widen and form a brown necrotic area. The spots are surrounded by white sporangium on a gray green background.
- ✓ Attacks can spread to stems, stalks, tubers and fruit. The attack of this disease can develop rapidly in the rainy season with humidity around the canopy of more than 95% with temperatures around 20 degrees Celsius.

Potato disease

Potato leaf rot

Phytophthora infestans

The attack of the pathogenic fungus Phytophthora infestans can reduce potato production by up to 90% of total potato production in a very short time.

Phytophthora infestans, the fungus can attack leaves, stems, and tubers in the soil.
This is what causes this pathogen to be very important to control immediately.

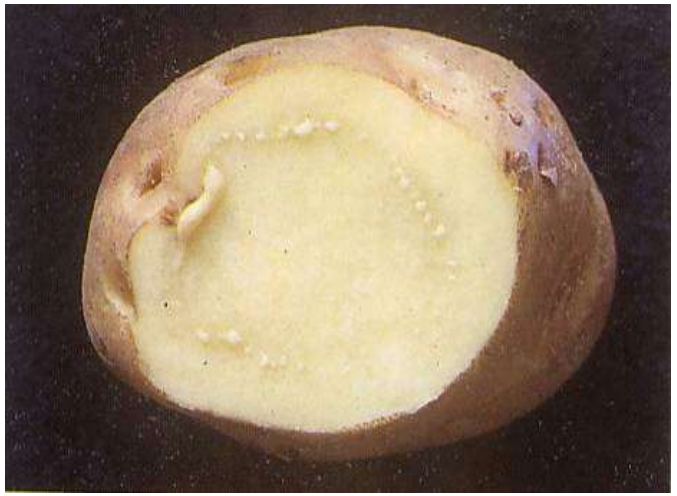
Potato Disease

2. Bacterial wilt disease

Bacterial wilt disease is caused by the bacterium *Ralstonia solanacearum.*

This pathogen is transmitted through water.
The initial symptom is that the plant wilts starting from the shoots spreading to the bottom of the plant until all the leaves wither and eventually the plant dies.
Disease will develop rapidly in the rainy season.

Plant Its hosts include: chilies, tomatoes, and potatoes.



Symptoms of potato bacterial wilt attack

Control

The attack of Phytophthora fungi and Ralstonia bacteria can be prevented in several ways:

1. soaking seeds, tubers soaked with a solution of FRESH vegetable pesticides for 15 minutes before planting.
2. If the soil is contaminated, then at the last tillage, and before planting, it should be sprayed evenly with FRESH.
3. If it has been attacked, the medicine is sprinkled on the root area at a dose of 100-200 ml per plant. Repeat once again after 4 days.
4. Biological agen: *Bacillus subtilus, Trichoderma* spp. *Pseudomonas fluorescens* ...

Notes:
Fresh solution consists of clean water and drugs with a concentration of 1%.

5. Mango diseases

4.1. Anthracnose

4.2. Powdery Mildew

4.3. Verticillium Wilt

4.1. Anthracnose

- ✓ **Anthracnose, the most important mango disease, is caused by the fungus Colletotrichum gleosporioides.**
- ✓ **Mangoes can cause diseases: flower blight, fruit rot, and leaf spot.**
- ✓ **Symptoms on panicles (clusters of flowers) begin as small black or dark brown spots.**
- ✓ **They further enlarge, coalesce and the flower eventually dies (deciduous) (Fig. 1), greatly reducing yield.**

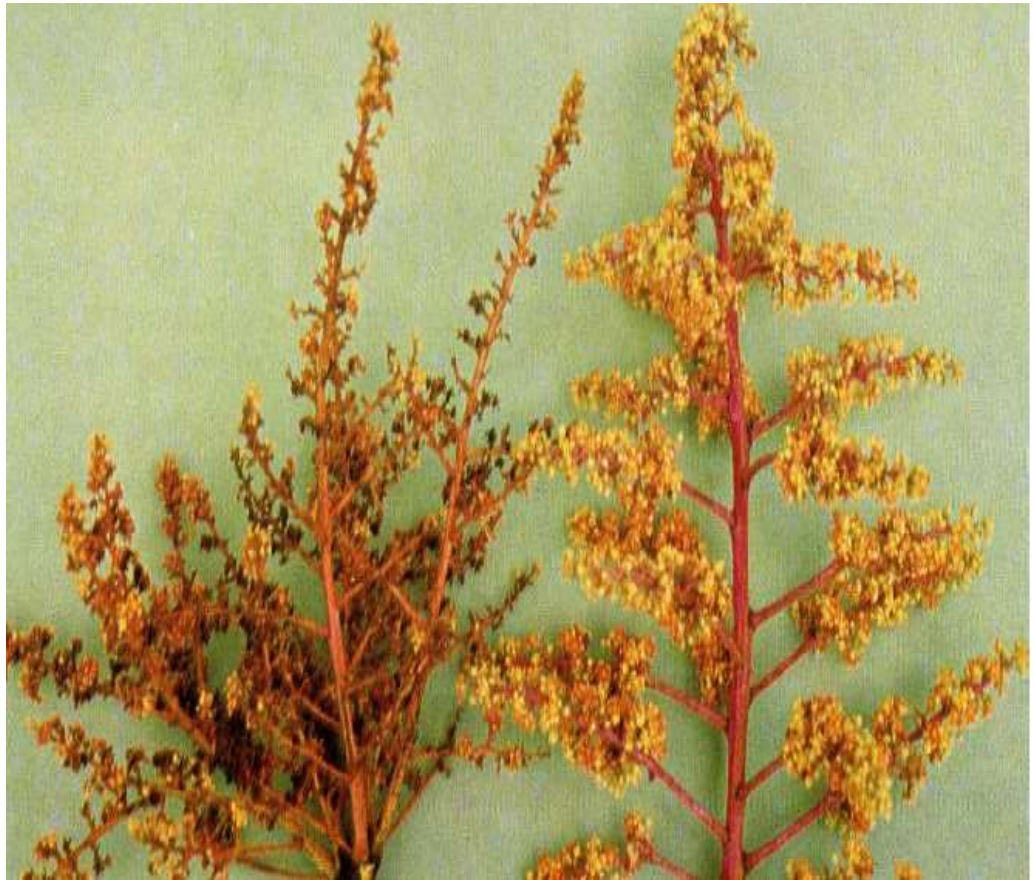


Figure 1.
Severe anthracnose infection in mango panicles (flower bunches, left) compared to near disease-free panicles (right).
Source: Ken Pernezny and Randy Ploetz, 2000.

4. Manggo

4.1. Anthracnose

On leaves, anthracnose lesions begin as small, angular, brown to black spots (Fig. 2). The tissue is young when initially infected, the spots may enlarge to form large dead areas (Fig. 2).

Lesions that begin on older leaves are usually smaller with a maximum diameter of 1/2 inch (6 mm); they appear as dark brown to glossy black angular spots.

Figure 2. Anthracnose infections in mango leaf. Note coalescence of lesions along mid rib.
Source: Ken Pernezny and Randy Ploetz, 2000

4.1. Anthracnose

- ✓ Fruit infection can cause serious rot in the garden, in transit, at the market, and after sale.
- ✓ Ripe fruit, either before or after picking, may then develop prominent dark brown to black rot spots (Fig. 3).
- ✓ These can coalesce and eventually penetrate deep into the fruit, resulting in prolonged fruit rot.
- ✓ Anthracnose is usually more serious in years when heavy rains and dew are common, from the beginning of flowering until the fruit is about half in size.

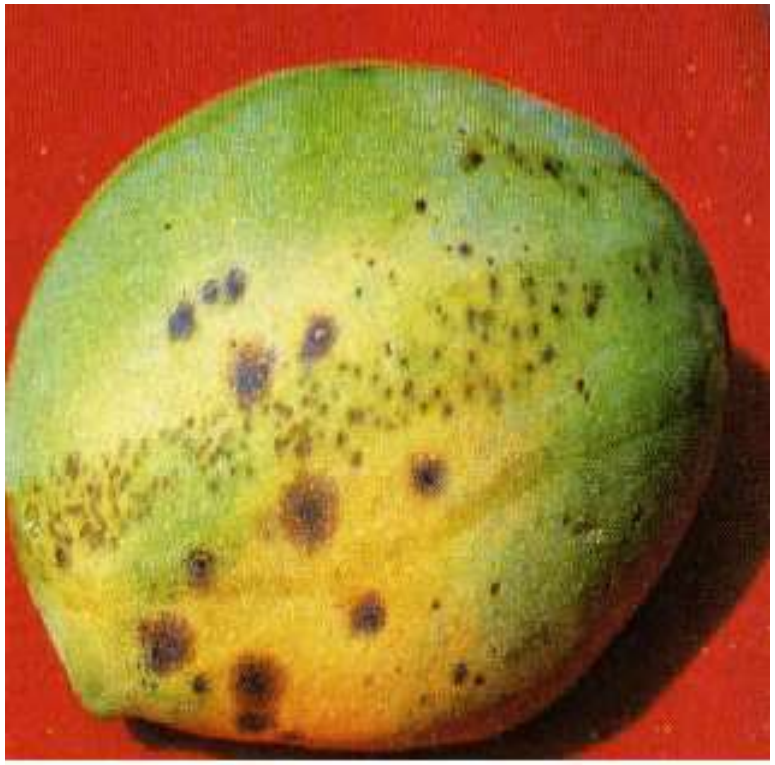


Figure 3.
Numerous circular areas damage in mango fruit.
Source: Ken Pernezny and Randy Ploetz, 2000

4.2. Powdery Mildew

Powdery mildew is caused by the Oidium mangiferae.

Although a somewhat sporadic disease, it can cause severe crop loss due to flower and panicle infection and subse quent failure of fruit set.

Figure 4.
Late-state powdery mildew infection on underside of mango leaf.
Source: Ken Pernezny and Randy Ploetz, 2000

4.2. Powdery Mildew

The diagnostic key in the identification of this disease is the appearance of a whitish, powdery growth of the fungus on panicles and young fruit. Young infected fruit turn brown and fall. The white growth can also be seen on the undersurface of young infected leaves. Se vere infection of young leaves results in premature leaf drop. On mature leaves, the spots turn purplish brown, as the white fungal mass eventually disappears (Fig. 4).

Powdery mildew occurs in the spring and is particularly destructive in years when the weather is cool and dry. Control is fungicide treatment.

Management: another control method is by spraying a liquid smoke solution mixed with a clove extract solution. Sprayed all over the leaves.

4.3. Verticillium Wilt

Verticillium wilt, caused by the soil-borne fungus *Verticillium albo-atrum* or *V. dahliae* is an increasingly important disease for mango production.

Figure 5.
Verticillium wilt of young mango tree.
Source: Ken Pernezny and Randy Ploetz, 2000

4.3. Verticillium Wilt

The problem is usually observed in young trees planted on fields previously planted with vegetables which are also susceptible to this disease. Verticillium fungi can survive in the soil in an inactive state for at least 15 years.

When the tree is planted in infested soil, the fungus returns to its active stage and attacks the mango roots.
When Verticillium colonizes and blocks the vascular (water-conducting) system, the tree begins to show symptoms of water shortage.

The dead leaves often remain attached to infected branches, giving the tree a “fired” appearance (Fig. 5). If longitudinal cuts are made in infected branches, brown vascular discoloration is often evident.

4. Management

1. Stem infusion

The stem is infused with a solution containing the compound eugenol which is put into an infusion bottle and then dripped through a needle into the stem's vascular.

A clearer explanation is in the video that we have prepared.

2. **Spraying**

- ✓ another control method is by spraying a liquid smoke solution mixed with a clove extract solution. Another control method is by spraying a liquid smoke solution mixed with a clove extract solution.
- ✓ sprayed evenly throughout the plant canopy.

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