DISEASE MANAGEMENT OF CROP AND HORTICULTURE PLANT

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Plant Protection Departement

ICAT Ketindan Malang Indonesia

Important Diseases

01 Rice: Blast & RYMV (Rice yellow mottle virus)

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

06 Potato Disease: Potato leaf rot n Bacterial wilt disease

1. Rice disease

1.1. Blast Disease

1. 2. Rice Yellow Mottle Virus (RYMV)

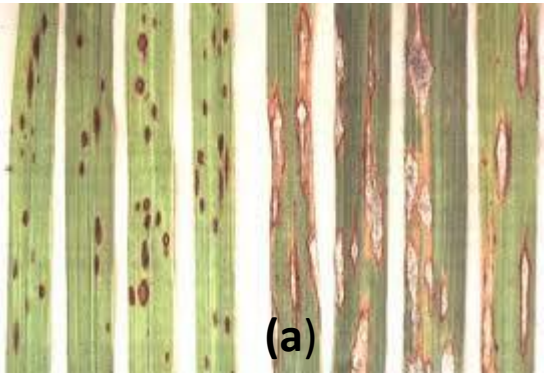
1. Rice Disease

1.1. Blast Disease

1.2. RYM Virus

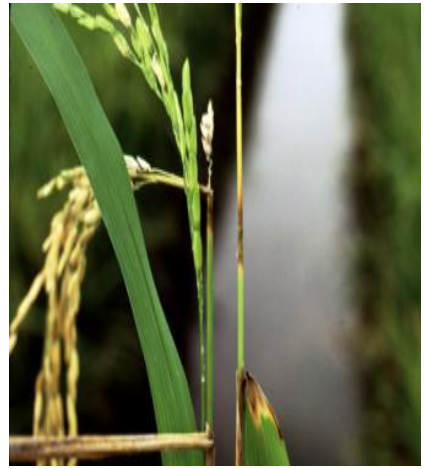
1.1. Blast Disease

- **Pyricularia grisea** fungus can infect all phases of growth from nursery to near harvest.
- In the seedling phase and vegetative growth, it infects the leaves and with symptoms in the form of a rhombus-shaped brown spot called a leaf blast (a).
- In the generative growth phase, disease symptoms develop on the stem/neck of the panicle called a neck blast (b).
- The severe development of neck blast disease can reach the grain (c) and the pathogen can be carried by the grain as a seed borne pathogen.



(a)

(b)



(c)

Symptoms:

The fungus produces spots or lesions on leaves, nodes, and panicles and grains. The spots are elongated and pointed at each end.

1.1. Blast Disease

Symptoms

Leaf blast

Node blast

Neck blast

Neck blast → Empty grains

1.1. Blast Disease

Biology of the fungus Pyricularia grisea

This mushroom has many races, is easy to change and forms new races quickly. One disease cycle takes about 7 days, which starts when the spores infect and produces a spot and ends when it spores (produces new spores) which are ready to be spread into the air.

One spot produces hundreds to thousands of spores in one night and can continue to produce spores for more than 20 days

1.1. Blast Disease

Ecology of the fungus *Pyricularia grisea*

Mushrooms like conditions of long dew periods, high humidity and night temperatures around 22–25 ^{O}C.

Other supporting factors:

1th. Excessive application of N fertilizers, nitrogen affects epidermal cells so that there is an increase in cell wall permeability and a decrease in levels of silica (Si) elements, so that fungi are easier to penetrate. The Si element helps the hardness and straightness of the leaves

2th. Soil under aerobic conditions and drought stress.

The primary inoculum source of blast disease in the field is straw.

In the tropics the source of the inoculum is always present throughout the year because spores are present in the air and an alternative host plant other than rice.

Disease cycle

Airborne spores called conidia land on leaves.

↓

The spores germinate and the fungus penetrates the leaf surface.

↓

The fungus grows and produces leaf spots after 4-5 days.

↓

The spores are released by dew or rain and are carried in the air to other plants.

Damage of blast:

In severe infections, yields may be reduced by 50 %.

Upland rice is more severely damaged than lowland rice.

Control

1. Technical culture

1. Healthy Seed Planting

a. Infected plants are not recommended for use as seeds.
b. Treat seeds with a systemic fungicide such as Trisikazole at a formulation dose of 3-5 g/kilogram or with a 0.5% eugenol solution.

2. Soaking the seeds

a. The seeds are soaked in a fungicide solution for 24 hours, and during the soaking period, the solution is stirred evenly every 6 hours.
b. Comparison of 1: 2 seed weight and volume of water.

Control

3. Seed coating

Soak the seeds in water, then drain them until the water doesn't drip again. The fungicide is mixed with 1 kg of wet seeds and shaken until evenly distributed, then the grain is dried to dry, then the seeds are ready for sowing.

4. How to plant

a. The spacing is not too dense or the legowo system so that environmental conditions are not favorable for pathogens.
b. intermittent watering

5. Fertilization

Nitrogen fertilizers have a positive correlation with disease severity. On the other hand, Potassium fertilizer causes plants to be more resistant to stress.

2. Rice Yellow Mottle Virus (RYMV)

RYMV is known only in Africa and one of the most damaging diseases of rice in Africa.

Vektor: *Dicladispa viridicyanae*

or: *Dicladispa viridicyanae*

Symptoms

- Stunting of rice plants if infected at early stage.
- Reduced tiller number.
- Yellowing and mottling of leaves.
- Infected plants are easily attacked by other diseases such as brown spot.

2. Rice Yellow Mottle Virus (RYMV)

Transmission of RYMV

. RYMV is transmitted by a vector and also mechanically.

. Five chrysomelids are known as vector insects.

. RYMV is not transmitted by the rice seed.

Damage of the RYMV

. Plants infected at early stages are more severely damaged than those that are infected later.

. Plants infected before maximum tillering stage show incomplete panicle emergence and have unfilled grains.

. Plants infected at later stage (older than 70 days) show no significant yield loss.

2. Rice Yellow Mottle Virus (RYMV)

Control of RYMV
. There are no practical ways (no chemicals) of curing a plant after it becomes infected.
. The only way to control RYMV is to prevent the rice plant from becoming infected.

Control Methods

- Resistant varieties: Planting resistant varieties is the cheapest and the most effective way of controlling RYMV.
Resistant varieties: NERICA 4, NERICA 6 and WITA 9
- Control of vectors: It is difficult to control virus vectors with insecticides.
Even low vector populations can cause RYMV infection.
- Eliminating sources of virus: Rogue (remove) infected rice plants from the rice field. Roguing is successful when only a low percentage of plants are infected. Prevent ratoon growth, which is the main source of RYMV.

Noted: I offer the use of anti-virus drug called OVIS. So far it has been successful in controlling curly virus and yellow virtus in chilies. It works by stopping the proliferation of RNA so that the virus cannot reproduce and eventually die completely. It took 2x4 days to recover.

2. Maize (Corn)

2.1. Anthracnose (*Colletotrichum graminicola*)

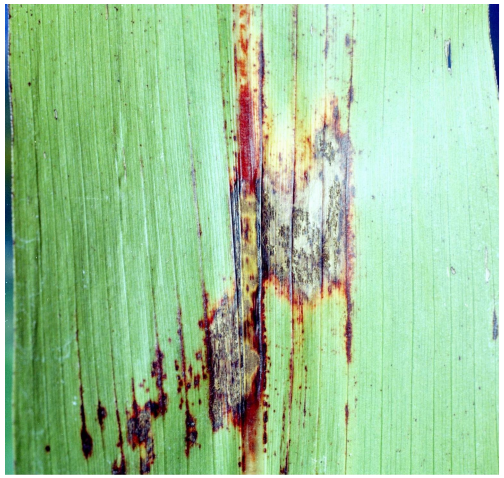
2.2. Common smut (Boil smut, Blister smut) Ustilago zeae

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)

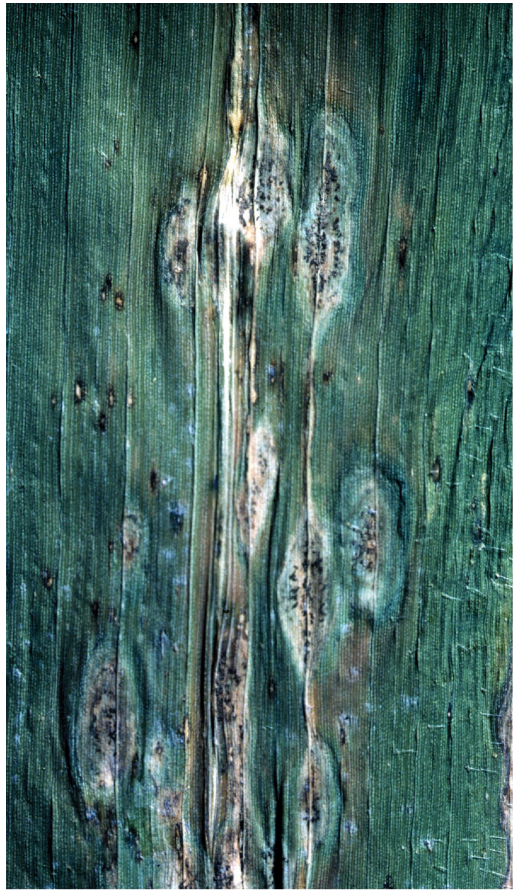
2. Maize (Corn)

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

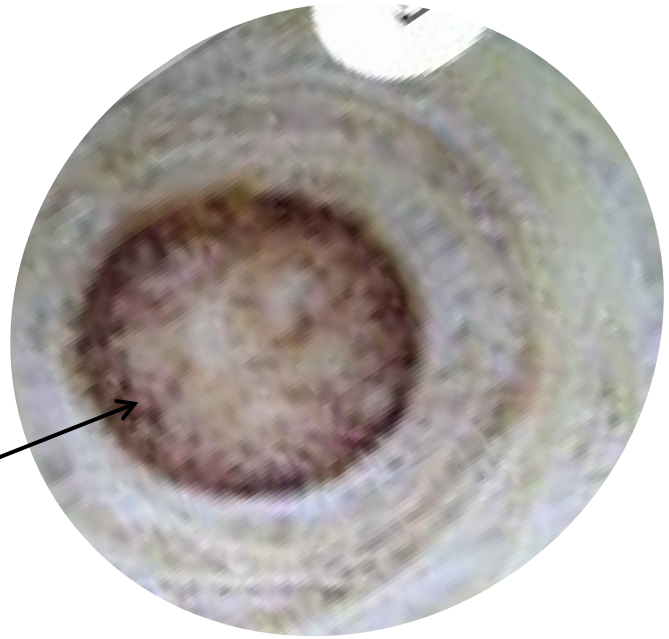
3.1. Panama Disease

3.2. Blood Disease Bakteria

3. Banana Disease

3.1. Panama Disease

3.2. Blood Disease Bakteria



Symptoms

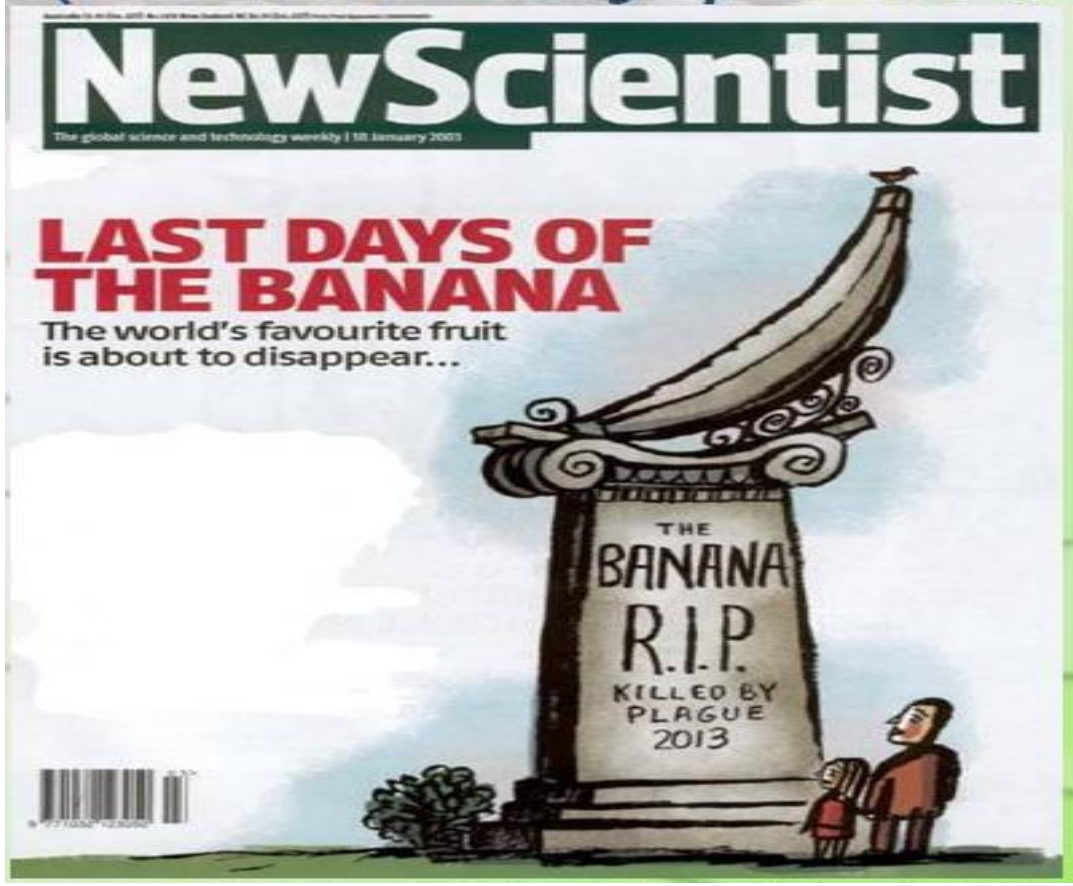
3.1. Panama disease

(*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

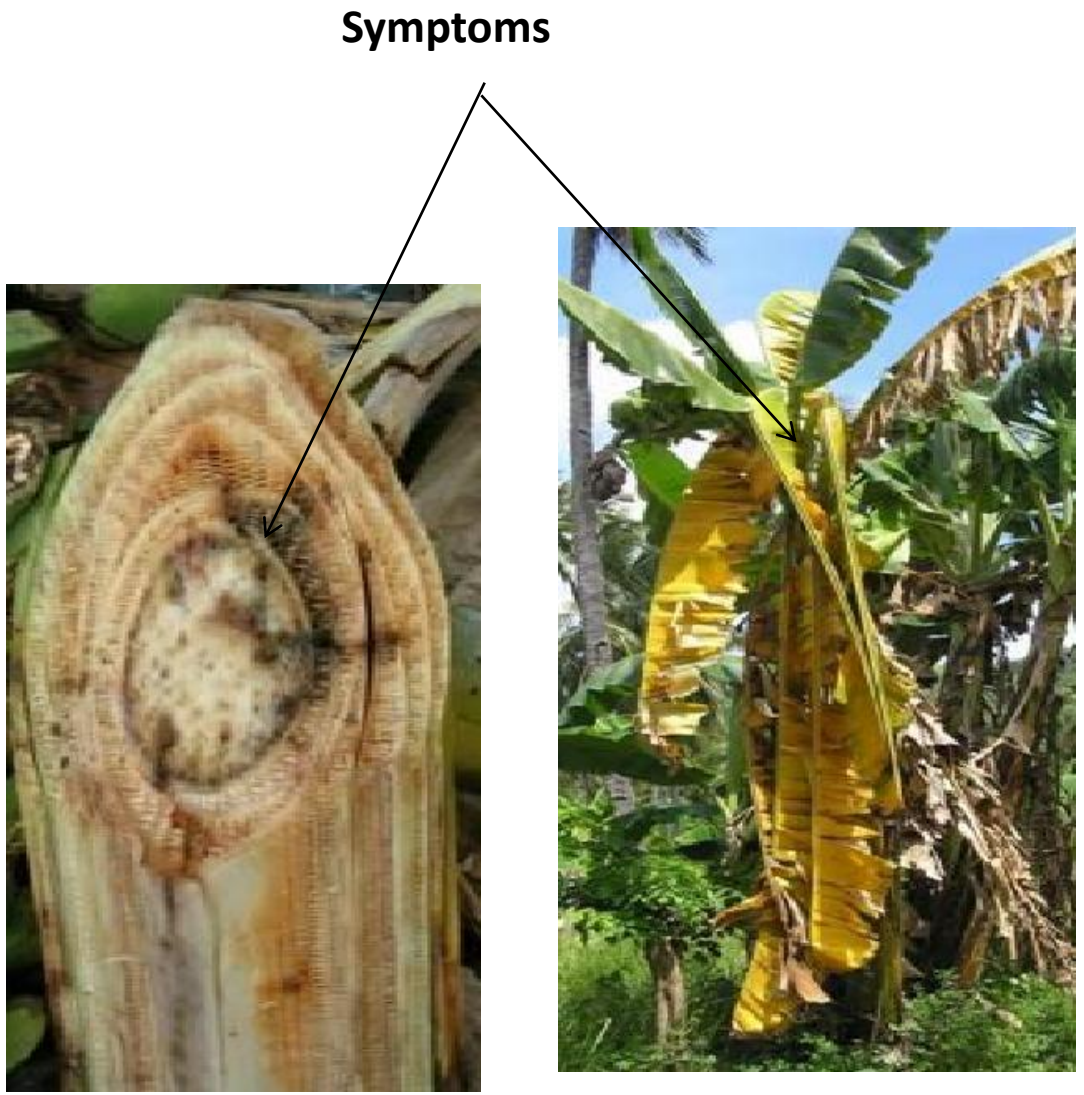
- Gardens with light shade are less susceptible to disease disturbances. Foc fungi can also survive a long time in the soil (30 years).
- Soil that has been infected is difficult to recover from this fungus.
- As primary pathogens, fungi can infect host tissue before other pathogenic fungi attack and 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.

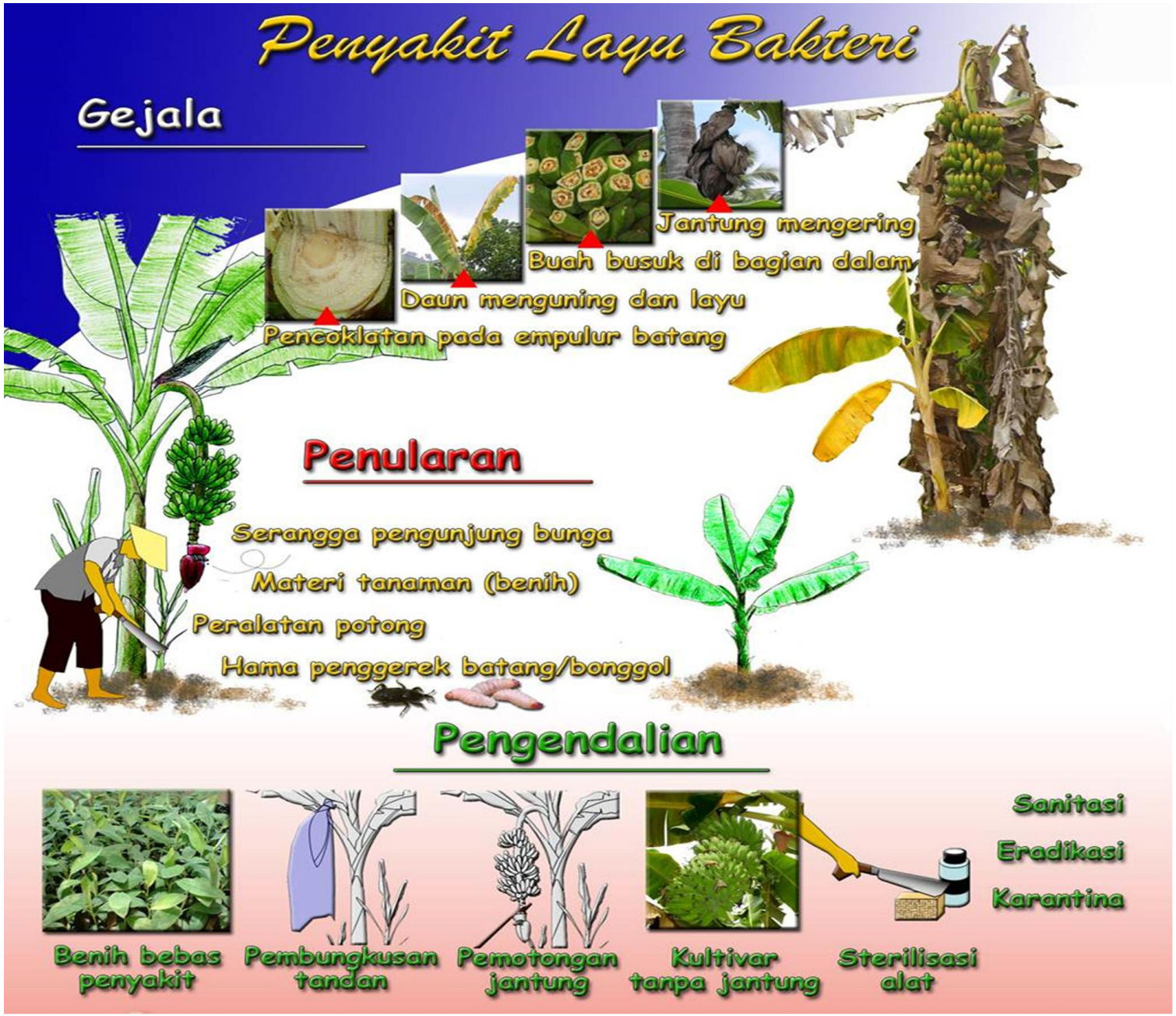
Ecobiology

3.2. Blood Disease Bacteria (Pseudomonas solanacearum)

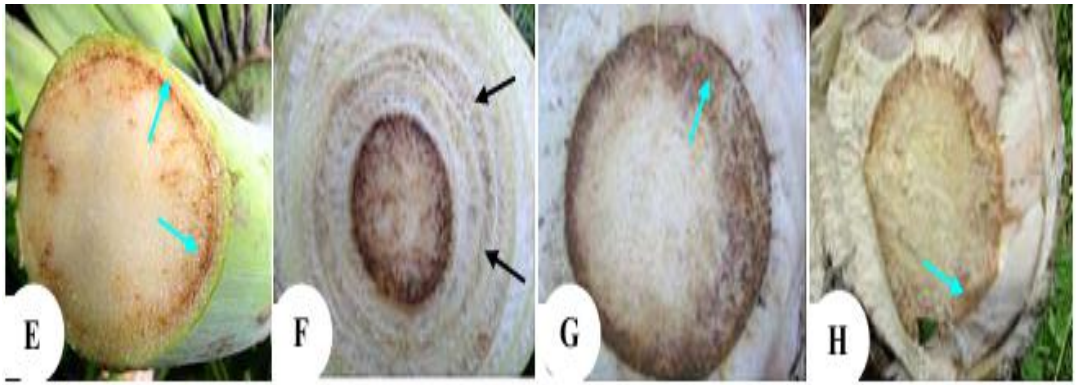
- The bacteria survive on diseased plant debris.
- The only host is banana n Heliconia. The Ambon n Raja banana is vulnerable, the horn stick is rather resistant
- Low saprophytic power
- Contagious via sick seeds, cutting tools, hoes and flower pollinators.
- Nematode infestation can be an entry point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



3.2. Blood Disease Bacteria (Pseudomonas solanacearum)



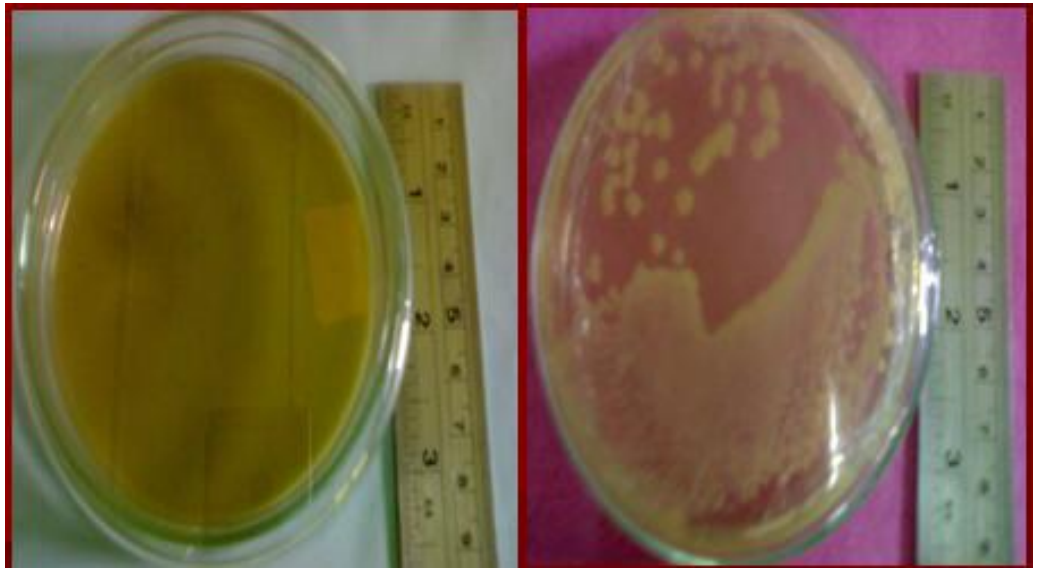
Symptoms



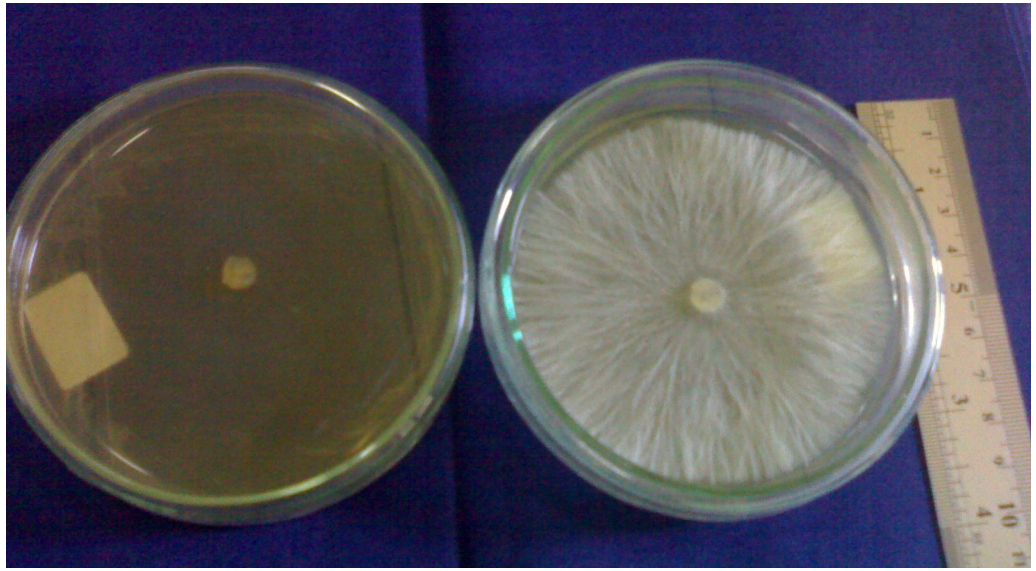
- The leaves appear yellow, starting from the youngest leaves, the midribs, then they break and get closer to the pseudo-stem.
- When the stump or pseudo-stem is split, a white to red discharge will appear (bloody banana disease /BDB).
- If the stem is still healthy but the fruit is rotten, it means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

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.

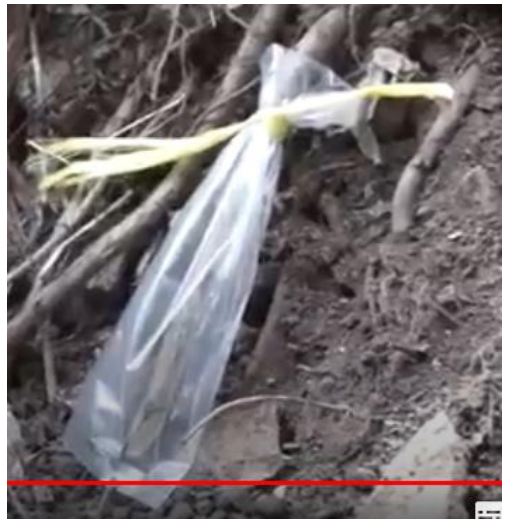
2. Root Infusion

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.

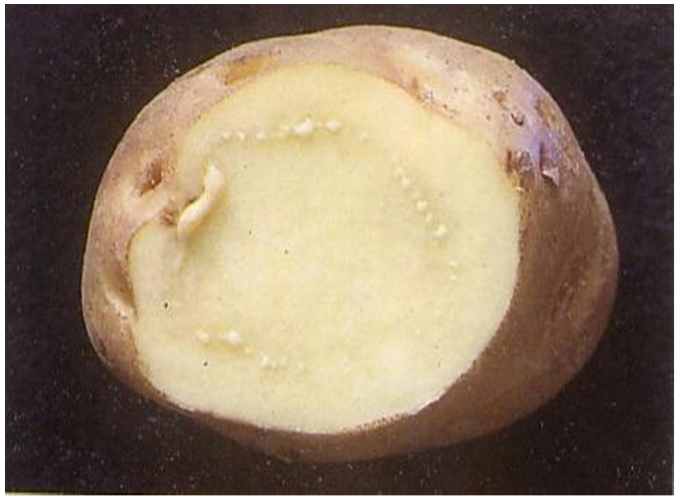
Potato Disease

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.

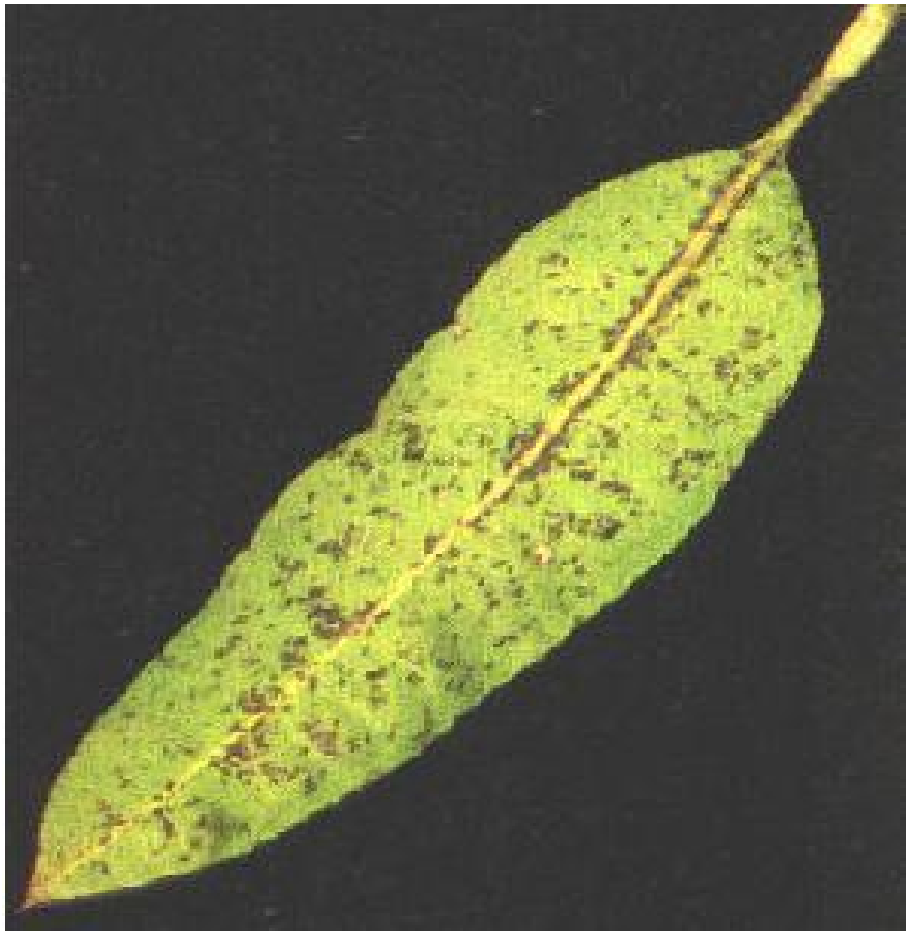


Figure 2. Anthracnose infections in mango leaf. Note coalescence of lesions along mid rib.
Source: Ken Pernezny and Randy Ploetz, 2000

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.

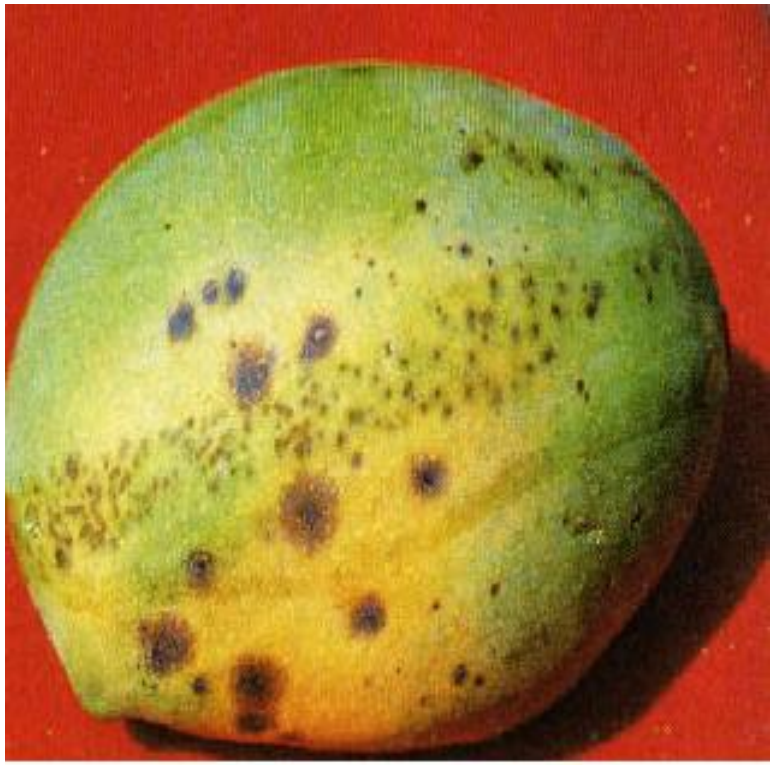


Figure 3.
Numerous circular areas damage in mango fruit.
Source: Ken Pernezny and Randy Ploetz, 2000

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.

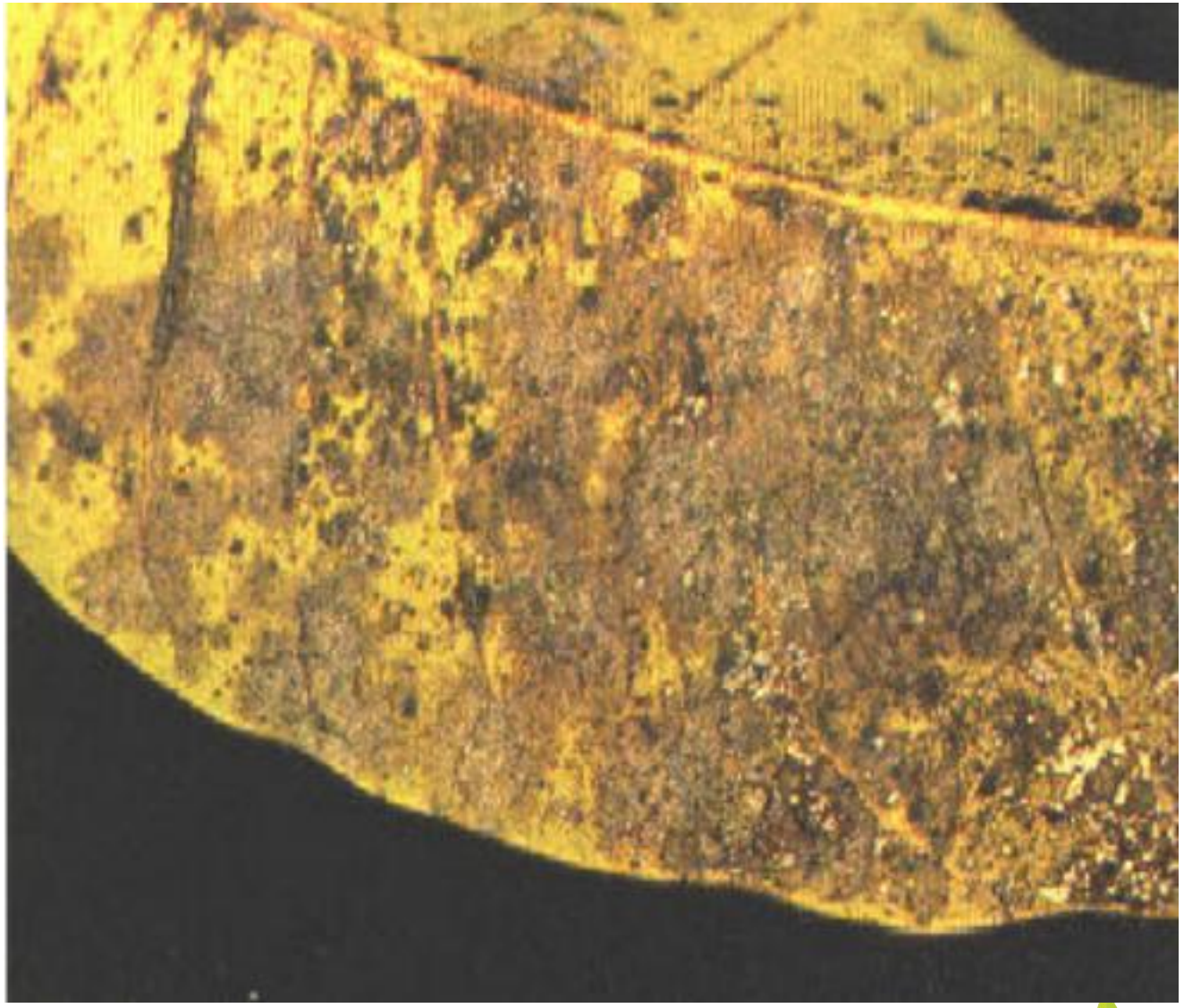


Figure 4.
Late-state powdery mildew infection on underside of mango leaf.
Source: Ken Pernezny and Randy Ploetz, 2000

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.

6. Cacao disease

5. Cacao

5.1. Cocoa pod rot disease

- ✓ One of the important diseases of cocoa is fruit rot (blackpod) caused by the fungus Phytophthora palmivora Butl.
- ✓ Losses due to this disease differ between regions or countries.
- ✓ The amount of losses due to this disease reaches 20-30% and plant mortality is 10% per year.
- ✓ This disease attack can reduce cocoa production by up to 44%. P. palmivora is one of the most serious pathogens of cocoa worldwide.

- ✓ Phytophtora palmivora has a wide host range that can attack 138 plant species belonging to various families (Chee, 1969). To be able to breed, this fungus requires a certain temperature and humidity.
- ✓ Disease development was higher at the optimum temperature of 31^{o}C (Tucker, 1931 in Agrios 1996).
- ✓ This fungus has been known since 1886 in Indonesia and has become an important disease in plantation crops (Muller, 1935 in Agrios, 1996).
- ✓ P. palmivora can attack various plants, thus the source of inoculum is always in the field.

5. Cacao

5.1. Cocoa pod rot disease

Symptoms of fruit rot

Can be found from the tip, base, middle, nipple fruit, young, old, fruit that is under, in the middle, or on the tree.
When the affected cocoa pod is split open, the seeds and flesh of the fruit are rotten, brown (Figure 6). In advanced infection, cocoa beans will change color and wrinkle (Bowers et al., 2001).

Figure 6. Symptoms of cocoa pod rot disease (photo: Rubiyo)

5. Cacao

5.1. Cocoa pod rot disease

Symptoms of fruit rot

Guest (2007) explained that initially the spots on the fruit were small, such as dirty, thick and found at every stage of fruit development, then the spots develops rapidly covering the internal tissues and the entire surface of the fruit, including the seeds.

Pathogens attack the internal tissues of the fruit and cause the cocoa beans to wrinkle and change color, diseased fruits eventually turn black and mummify.

Bioekology

will be blackish brown on the surface, become wet rot, and then the symptoms spread to cover the whole fruit surface.

On the blackened part, a white powdery layer will appear which is a secondary fungal spore and there is also a Phytophthora sporangium (Semangun, 2000).

If the environmental conditions (humidity) are suitable, the white mycelium containing sporangium will cover the entire surface of the fruit.

The spread of P. palmivora disease can be through water, ants, mice, squirrels, and snails found in cocoa plantations.

Management control

1. Resistant clones contain phenolic compounds post higher infection rate than moderate and susceptible clones. Cocoa clones ICS 6, Sca 12, Sca 6 DRC 15, DRC 16, ICCRI 4 and ICCRI 3.
2. The application of *Trichoderma* sp. .. with a concentration of 150 ml, can suppress attacks by up to 15%, because the Trichoderma fungus is able to produce enzymes and antibiosis compounds that can inhibit and even kill pathogens. The antibiosis compounds are gliotoxin, glyoviridine and trichodermin, volatile and non-volatile antibiotics (Sharma and Dohroo, 1991 in Arya and Parello, 2010).
3. Technical Culture
   - Adjusting the humidity of the garden so that it is not too high, by adjusting the shade and pruning the cocoa plants.
   - Garden drainage, improved so that disease development is inhibited.

Management control

4. Mechanical

The rotten fruit on the tree is taken and collected, then buried to a depth of approximately 30 cm from the soil surface. This can suppress the source of infection as low as possible so that new infections are inhibited.

5. 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.

6. **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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