DISEASES OF SAFFLOWER

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Theni

Sclerotinia stem rot and head blight-*Sclerotinia sclerotiorum*

White mold

Symptoms :

- ✓ Stem infections by sclerotia first appear just after flowering and are accompanied by a soft, watery rot of basal stems.
- ✓ These lesions enlarge into a watery, rotten mass of tissue that is covered by a white moldy growth.
- ✓ Dark, irregularly-shaped sclerotia are often found in and around infected stems. Infection of stems and branches will cause affected plant parts to wilt and later die, taking on a bleached and dried
- ✓ Head infections first appear as small, water-soaked or bleached spots. The fungus continues to grow throughout the head, eventually decaying the entire head with large sclerotia

PI : Sclerotia- Apothecia – Ascospores

Management :

- ✓ Application and incorporation of the beneficial fungus *Coniothyrium minitans*
- ✓ Spraying Azoxystrobin @ 0.1 per cent

Cucumber mosaic : *Cucumber mosaic virus*

Symptoms :

- ✓ In CMV infected safflower plants young leaves show irregular yellow or light patches alternating with normal green areas.
- ✓ Leaves may become blistered and distorted and infected plants are stunted. In few plants primary leaves are produced, forming a rosette of leaves exhibiting mosaic mottling and from the centre of this, the axis bearing secondary leaves is produced.

Vector : ***Aphids gossypii, A. craccivora.***

Management :

- ✓ The disease can be controlled by roguing and destruction of the infected plants.Remove and destroy the diseased plants.
- ✓ Do not delay irrigation until the crop exhibits moisture stress symptoms.
- ✓ Spraying of systemic insecticides, Acepate 1.5 ml or Dimethoate 2ml, for the control of aphid vectors.

DISEASES OF MUSTARD

MAJOR DISEASES OF MUSTARD

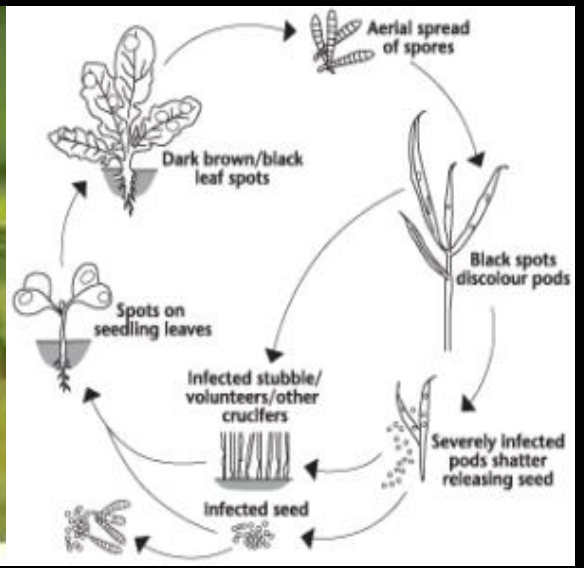
NAME OF DISEASES	CAUSAL ORGANISM
Alternaria blight	***Alternaria brassicae***
White rust	***Albugo candida***
Downy mildew	***Peronospora parasitica***
Powdery mildew	***Erysiphe cruciferarum***
Club root	***Plasmodiophora brassicae***
Sclerotinia stem rot	***Sclerotinia sclerotiorum***
Bacterial blight/Black rot	***Xanthomonas campestris*** **pv** ***campestris***

MINOR DISEASES OF MUSTARD

NAME OF DISEASES	CAUSAL ORGANISM
Bacterial soft rot	***Erwinia carotovora***
Mosaic	***Cauliflower mosaic virus***
Rai mosaic virus	***Turnip yellow mosaic virus***

ALTERNARIA BLIGHT, BLACK SPOT, GRAY SPOT – *Alternaria brassicae*

- Small circular brown necrotic spots with concentricwhich-coalesce to cover large patches showing blightening and defoliation in severe cases.
- Circular to linear, dark brown lesions also develop on stems and pods, which are elongated at later stage.
- Infected pods produce small, discolored and shriveled seeds.




Bruce Watt
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SURVIVAL AND SPREAD

- **Externally and internally seed born.**
- **In diseased plant debris or weed.**

FAVOURABLE CONDITIONS

- **>70% relative humidity**
- **Warm weather (12-25 °C)**
- **Intermittent rains**

MANAGEMENT

- **Crop rotation.**
- **Remove infected seeds.**
- **Use seed with high germination (over 90%).**
- **Spray copper oxy chloride - 0.1% or Mancozeb**
- **Biocontrol agents: *T. viride, T. harzianum, B .subtilis, Streptomyces rochei***
- **Resistant varieties-Safal,Agrani, Binasarisha 3, Binasarisha 4, Binasarisha 5, Binasarisha 6, Binasarisha 7, Binasarisha8**

WHITE RUST/ BLISTER - *Albugo candida*

- Both local and systemic infections are observed

- Local infection - white creamy yellow raised pustules appear on the leaves which later coalesce to form patches.

- Systemic infection and during humid weather, mixed infection of white rust and downy mildew cause swelling and distortion of the stem and floral parts due to hypertrophy and hyperplasia known as stagheads" that become brown, hard and dry as they mature

SURVIVAL AND SPREAD

- **Pathogen survives through oospores in affected host tissues and soil.**
- **Secondary infection - sporangia and zoospores**

FAVOURABLE CONDITIONS

- **>70% relative humidity**
- **Warm weather (12-25 °C)**
- **Intermittent rains**

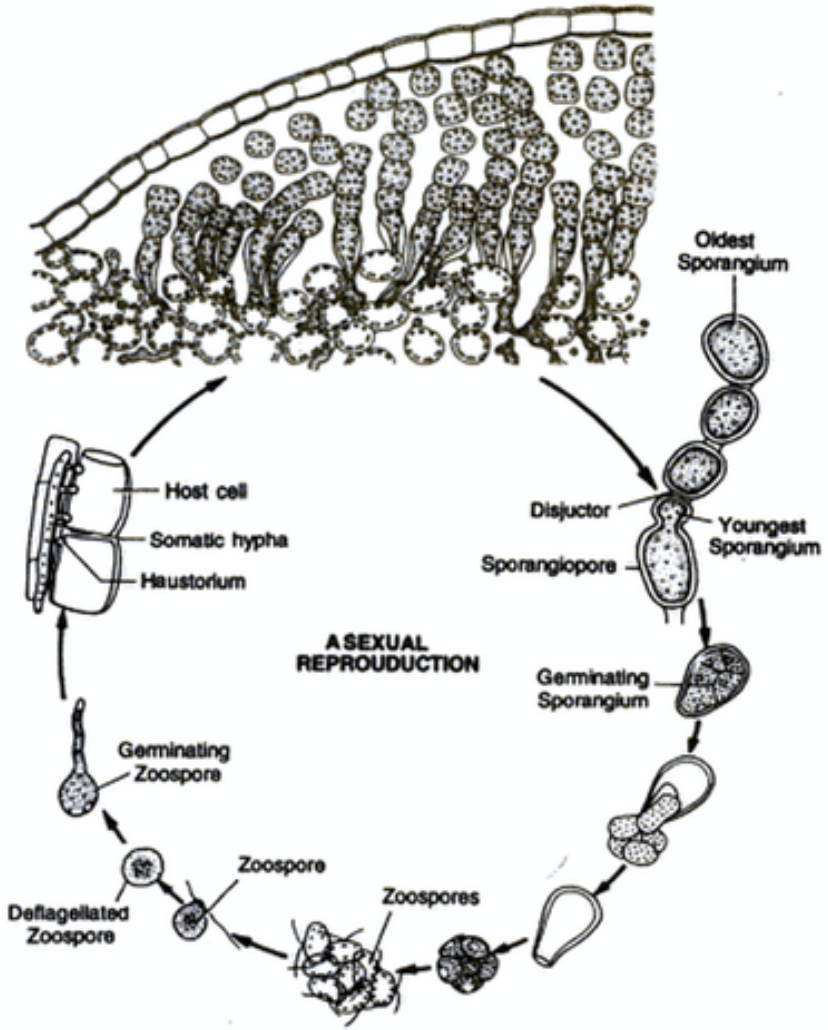
MANAGEMENT

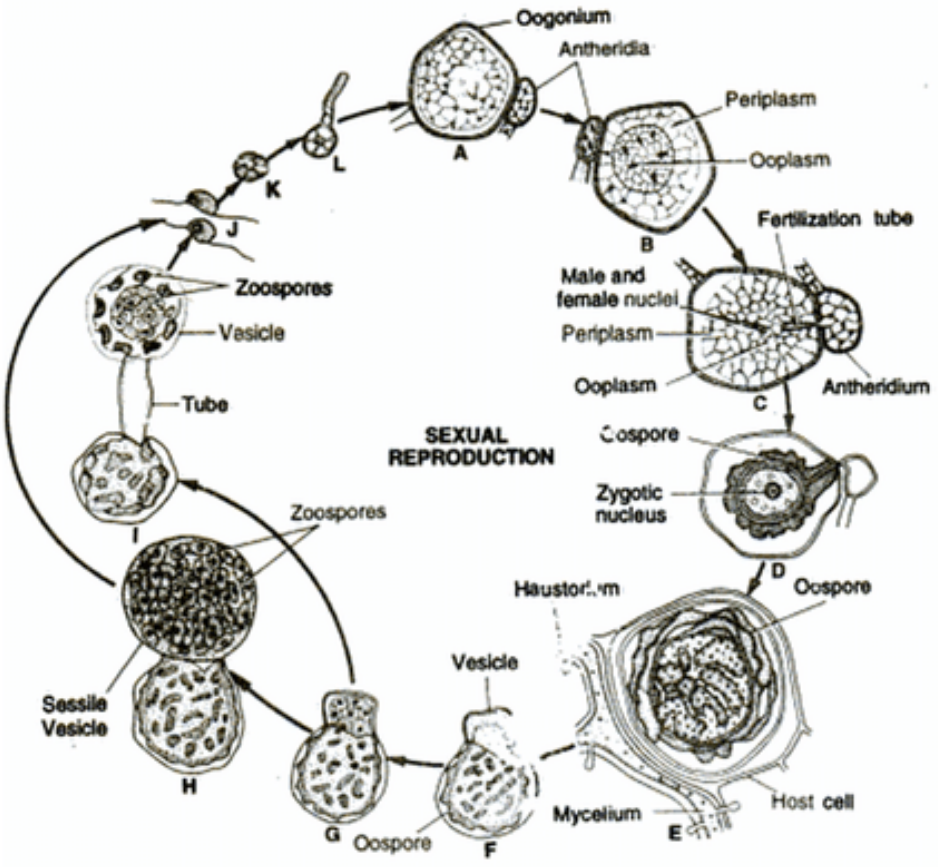
- **Argentine, Basanti , Maya (RK 9902), Jawahar Mustard2,**
  Him Sarson 1 (ONK 1) varieties are resistant.
- **Use at least a three year crop rotation**

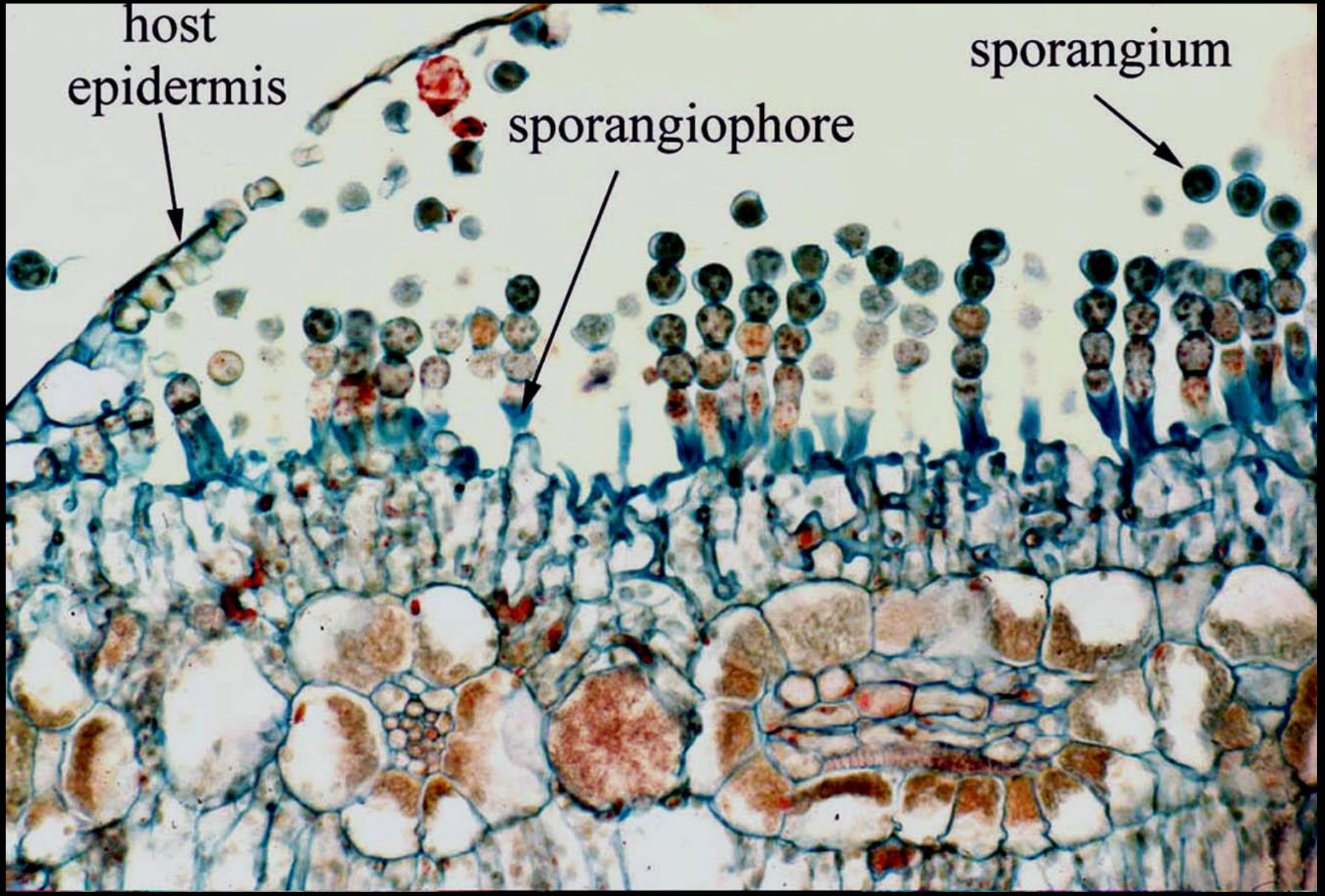
Staghead symptom

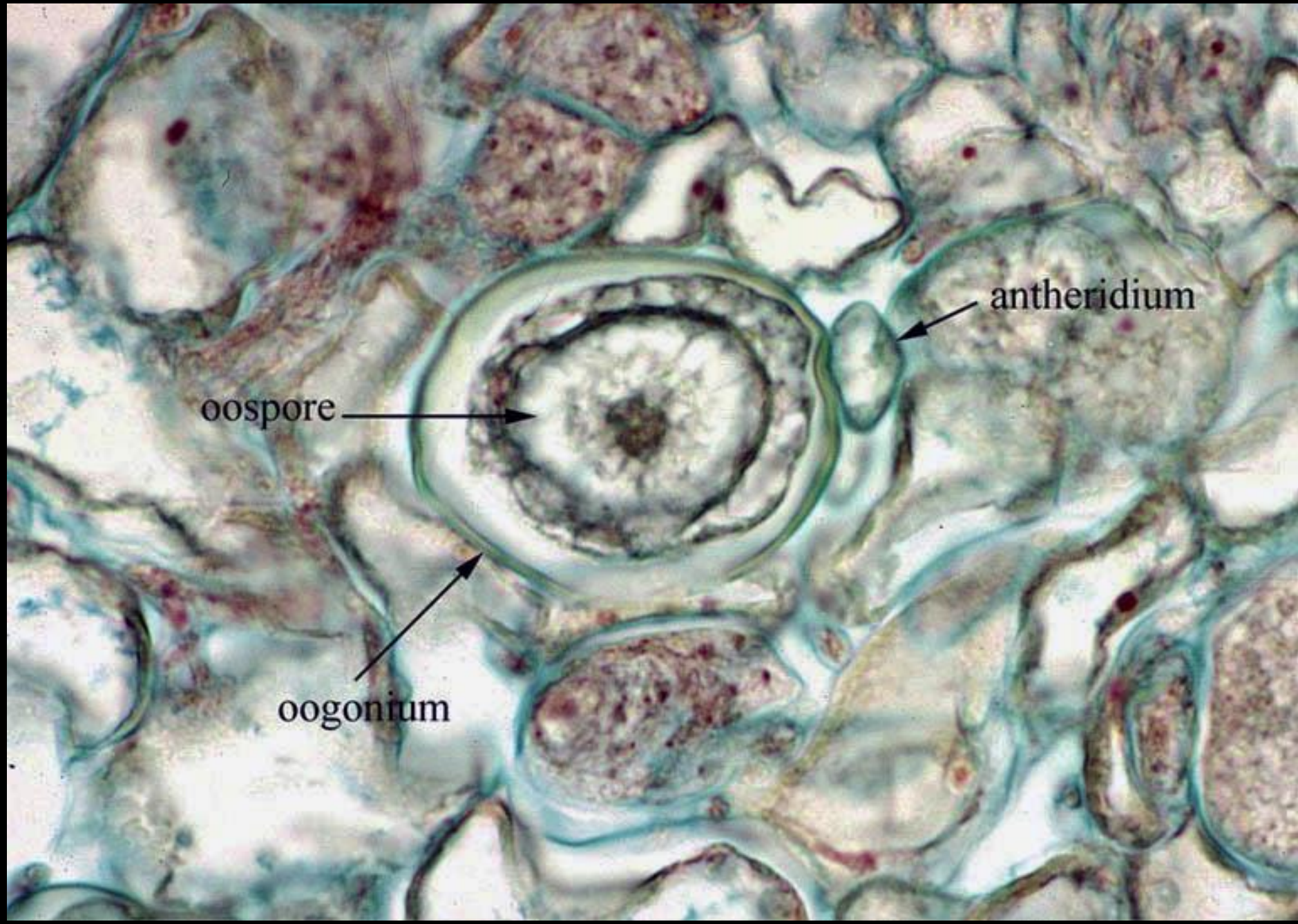
SEEDLING BLISTER- *Albugo candida*

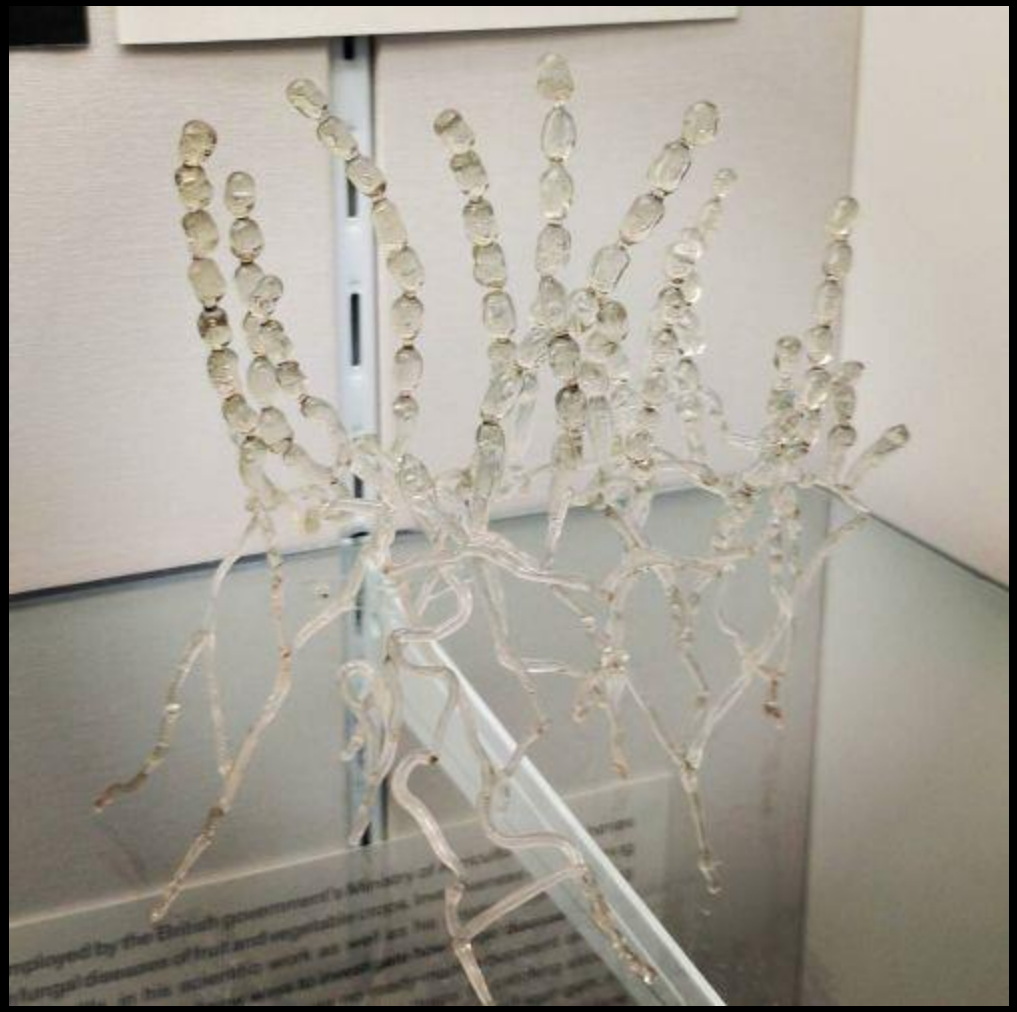
Life cycle of *Albugo candida* with (left) asexual reproduction and right (sexual reproduction)






host
epidermis
sporangiophore
sporangium

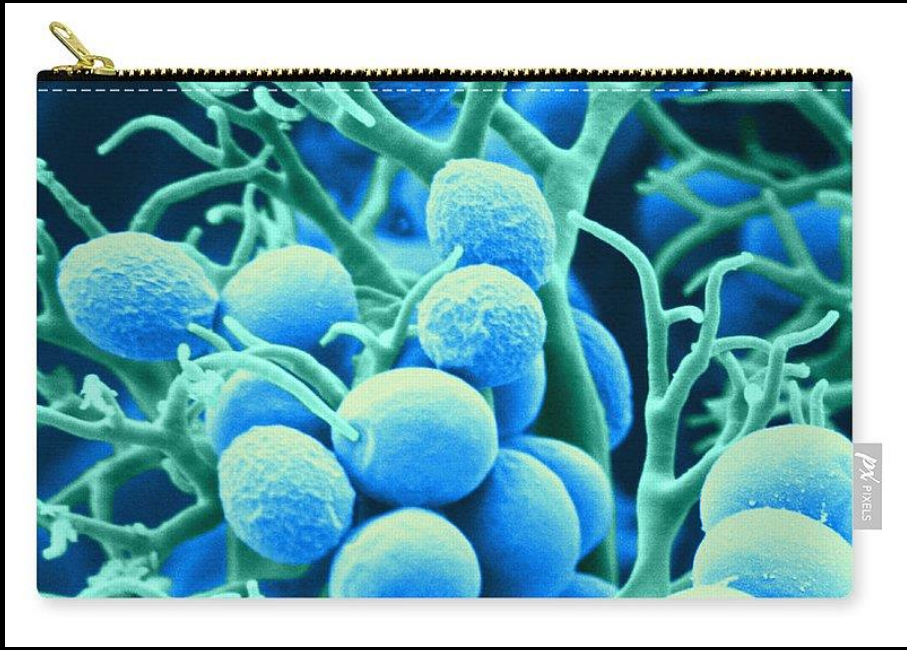

antheridium
oospore
oogonium



Handmade glass sculpture of *Albugo candida*

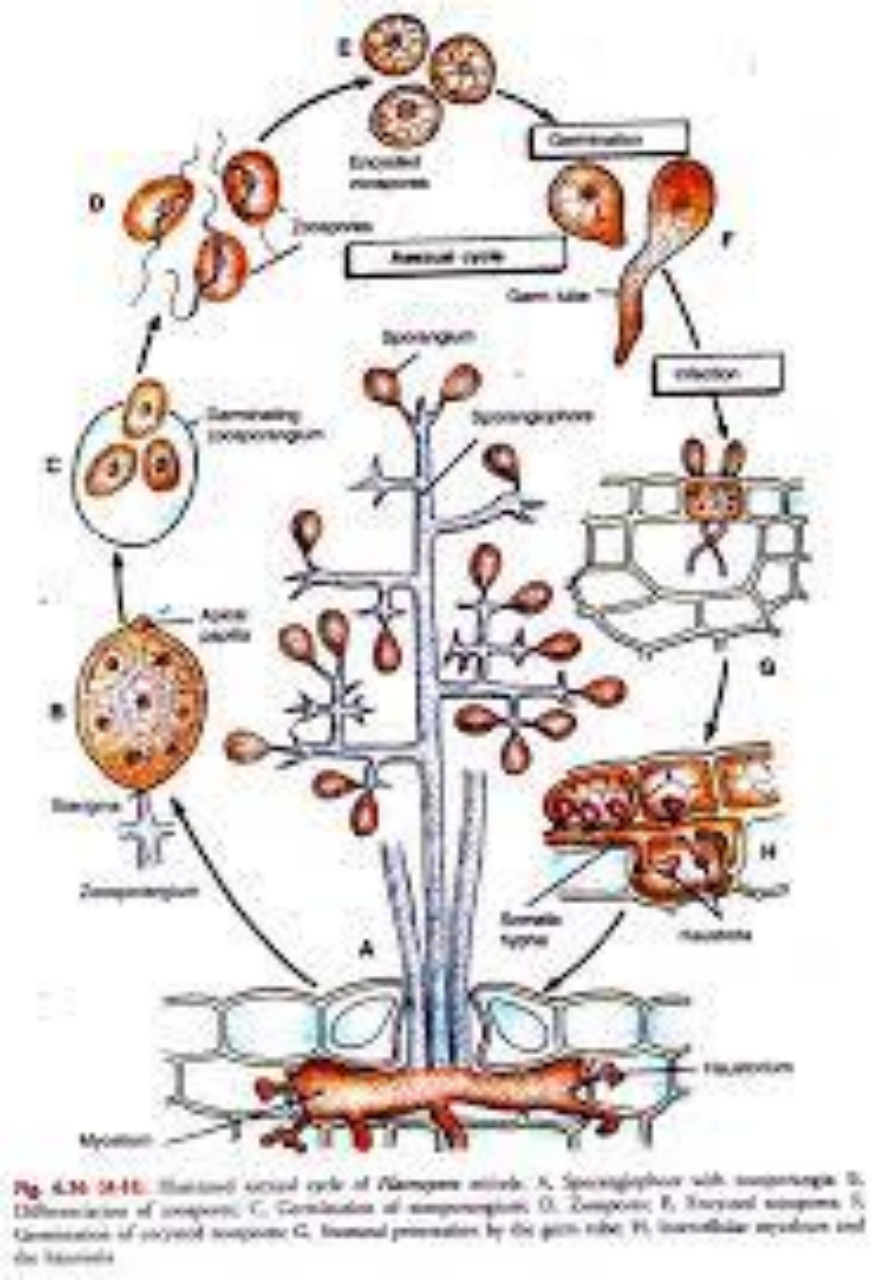
DOWNY MILDEW - *Peronospora parasitica*

- Grayish white irregular necrotic patches develop on the lower surface of leaves.
- Later under favourable conditions brownish white fungal growth may also be seen on the spots.
- The most conspicuous and pronounced symptom is the infection of inflorescence causing hypertrophy of the peduncle of inflorescence and develop stag head like structure.

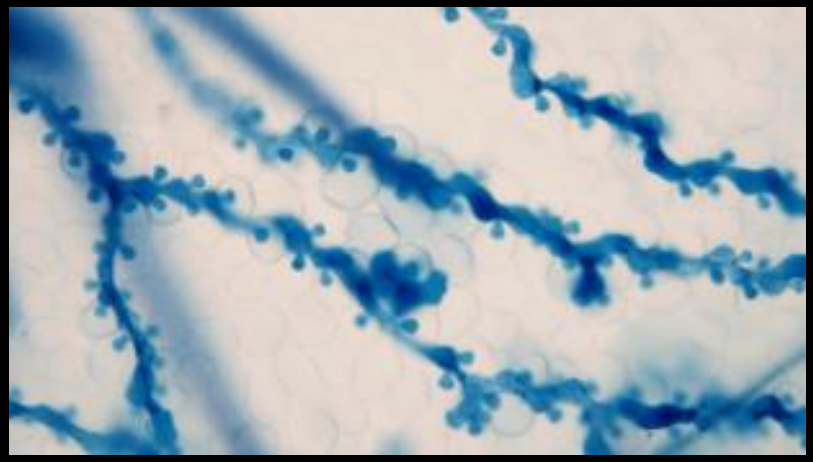



UGA5077029

Association or Mixed Infection of Downy Mildew and White Rust Disease Complex

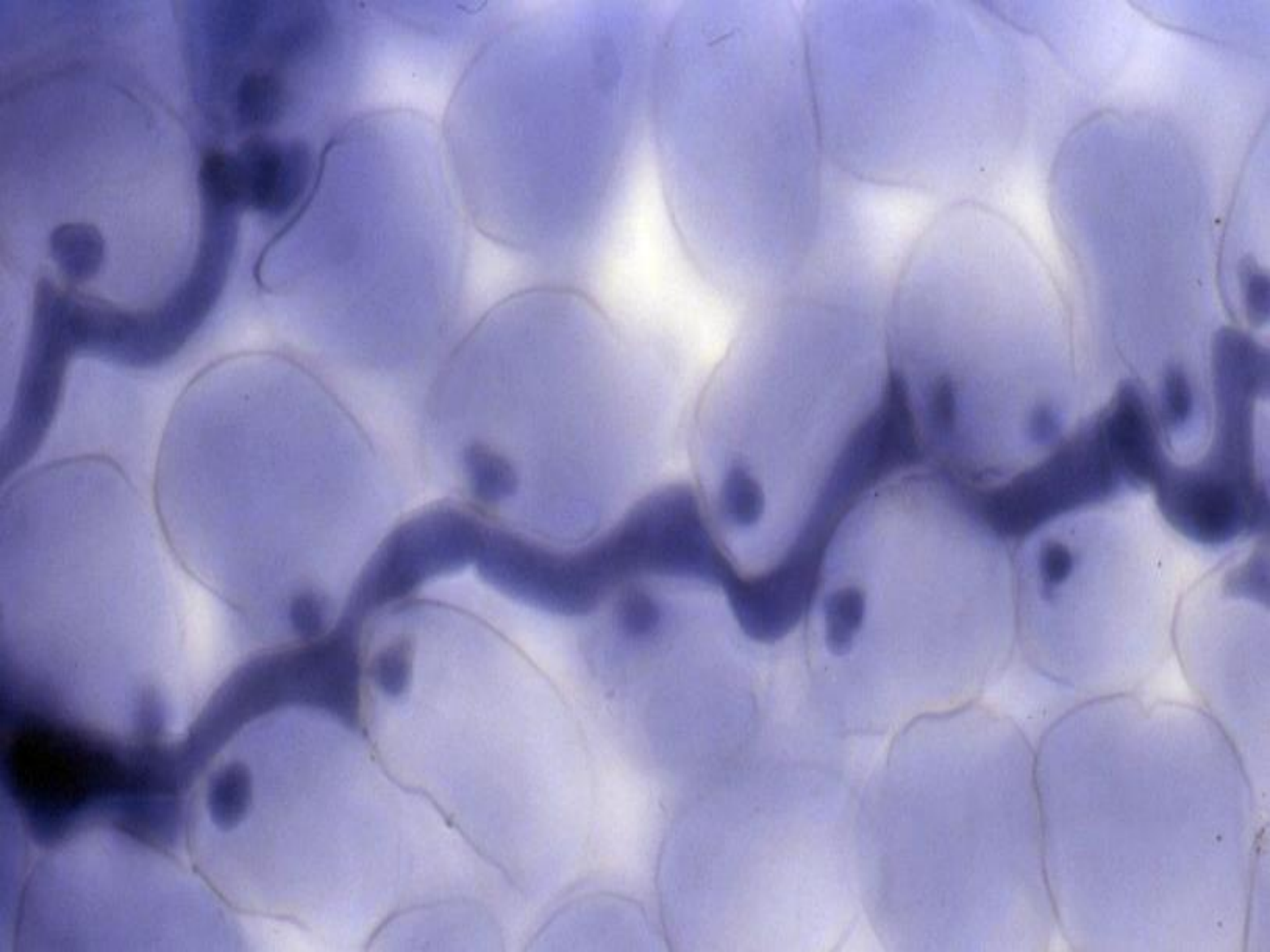


Comycete hyphae emerge from a leaf



Oomycetes feed by extending haustoria (round blue structures) into plant cells


Bruce Watt
5506034

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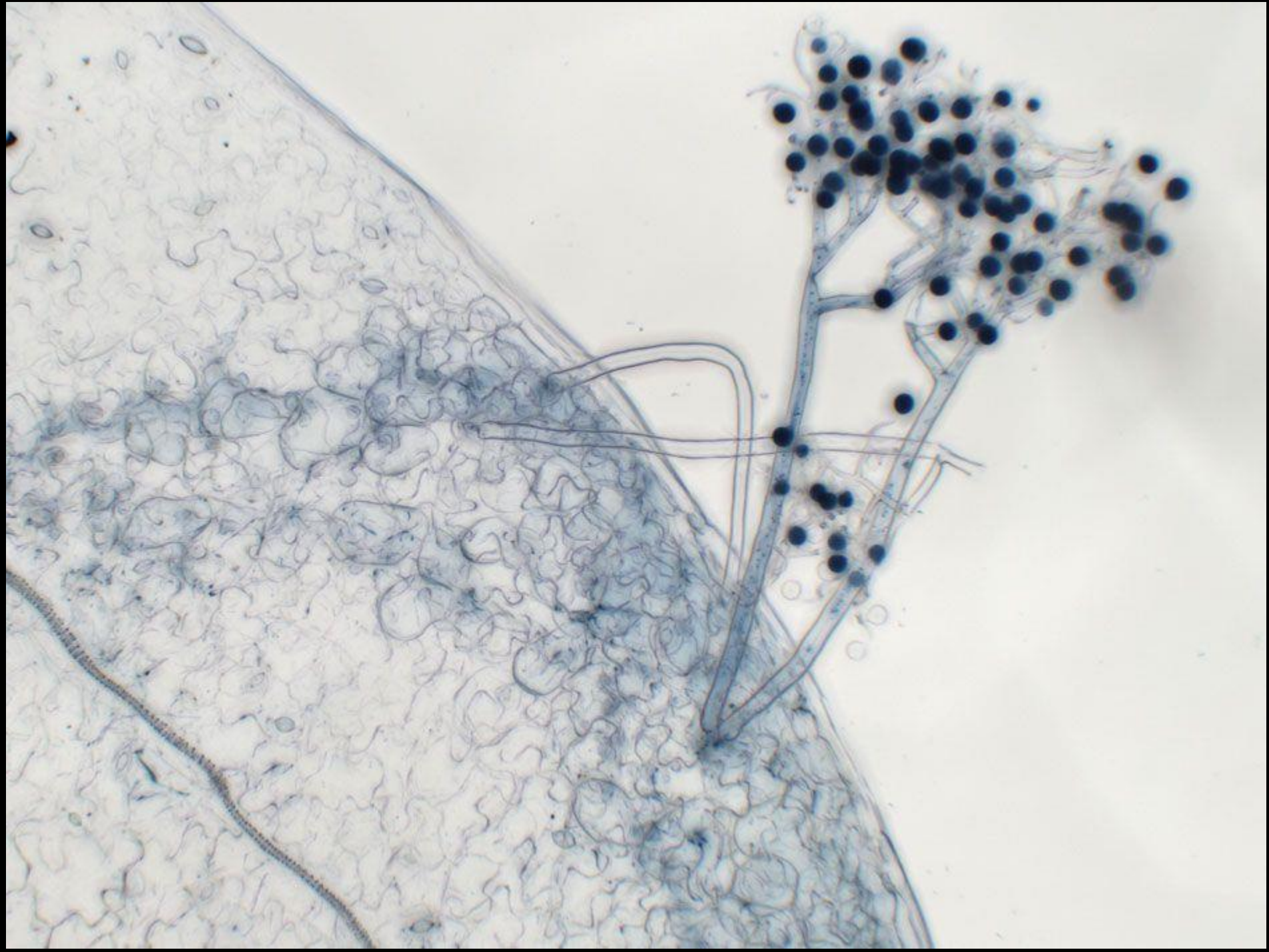
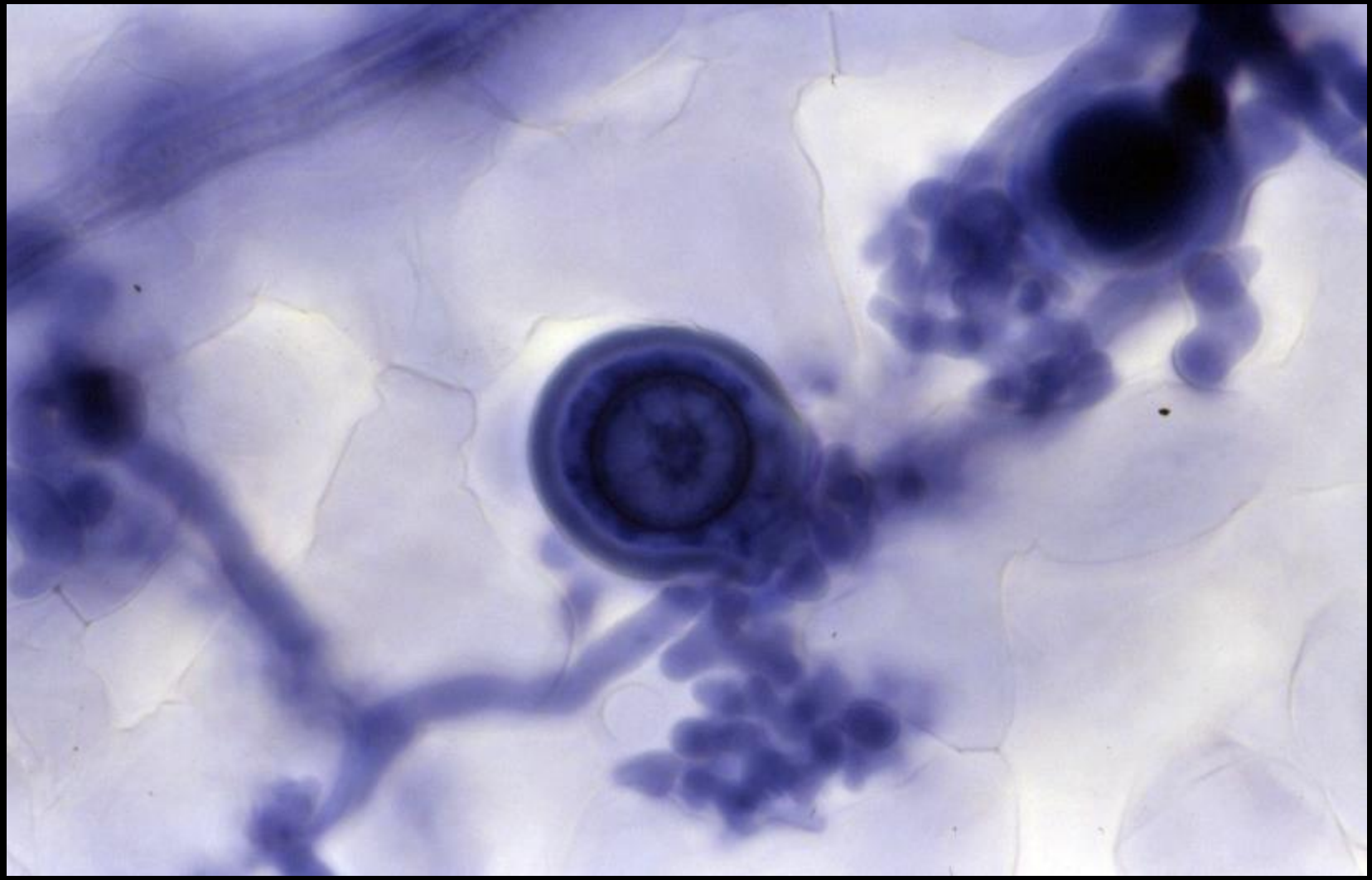
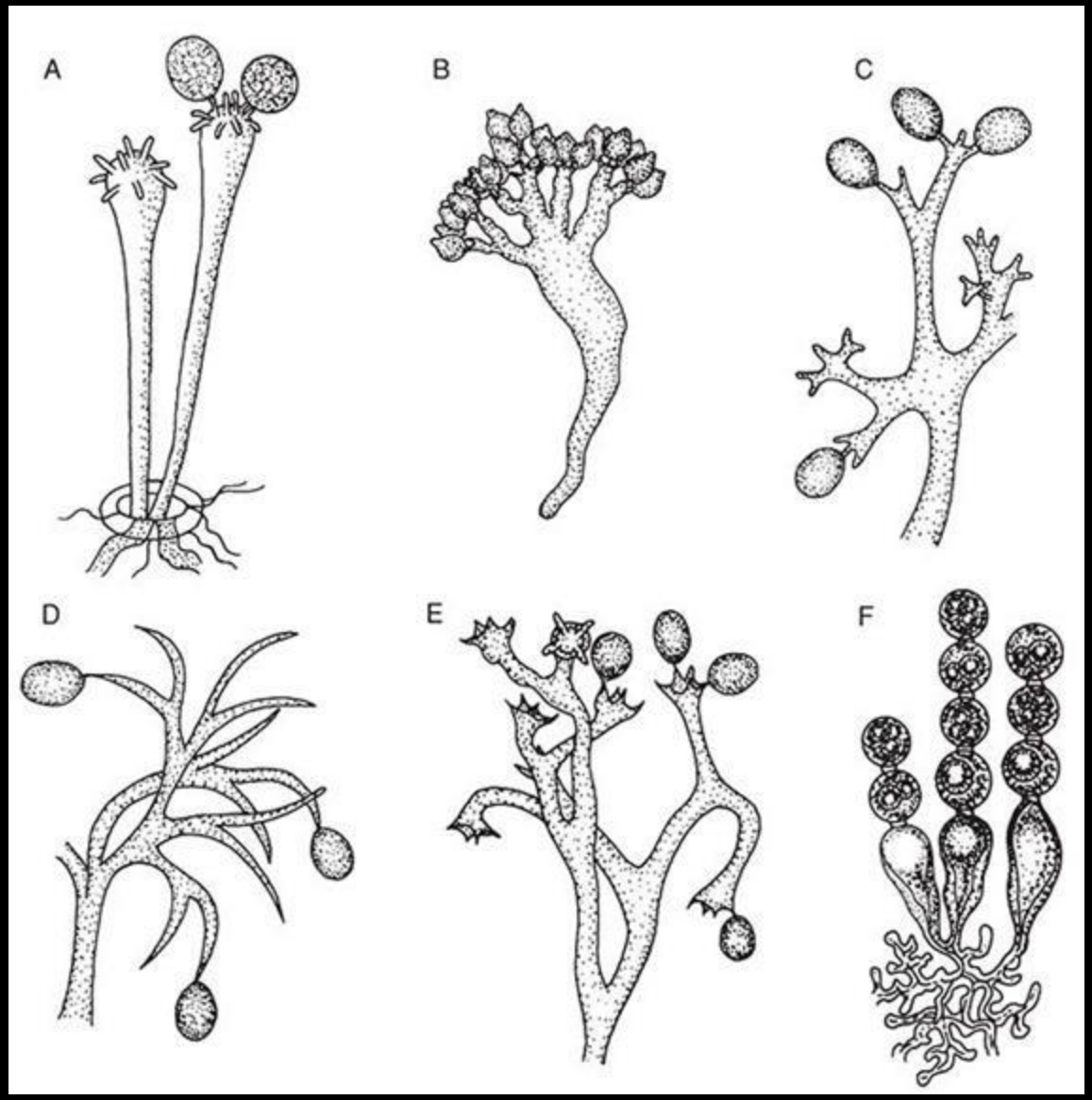




Peronosporales order some important tribes characteristic sporangium: A) Basidiophora , B) Sclerospora, C) Plasmopara, D) Peronospora, E) Bremia, F) Albugo



SURVIVAL AND SPREAD

- **The pathogen survives as oospores on the affected plant tissues in soil and on weed hosts.**

FAVOURABLE CONDITIONS

- **Atmospheric temperature - 10-20 °C**
- **Relative humidity >90%3**

MANAGEMENT

- **Control broad-leaved weeds.**
- **Use of cleaned seed.**
- **Resistant varieties –Uttara, Him Sarson 1**
- **Seed treatment – Apron @ 6g/ kg**
- **Spraying Metalaxyl @ 0.2 %**

POWDERY MILDEW - *Erysiphe cruciferarum*

- Symptoms appear as dirty white, circular, floury patches on either sides of the leaves.
- Under favourable environmental conditions, entire leaves, stems, floral parts and pods are affected.
- The whole leaf may be covered with powdery mass

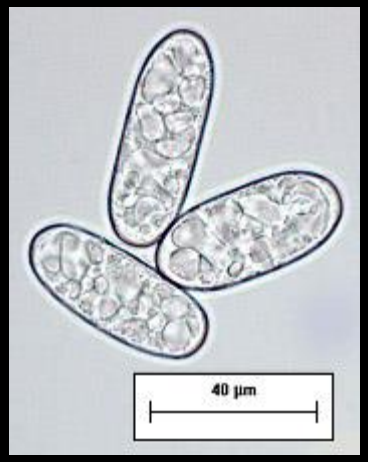
Erysiphe cruciferarum

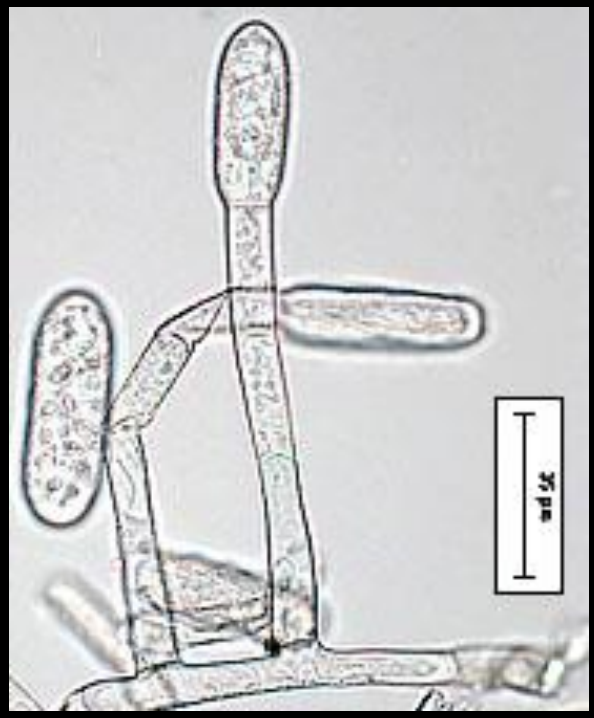
SURVIVAL AND SPREAD

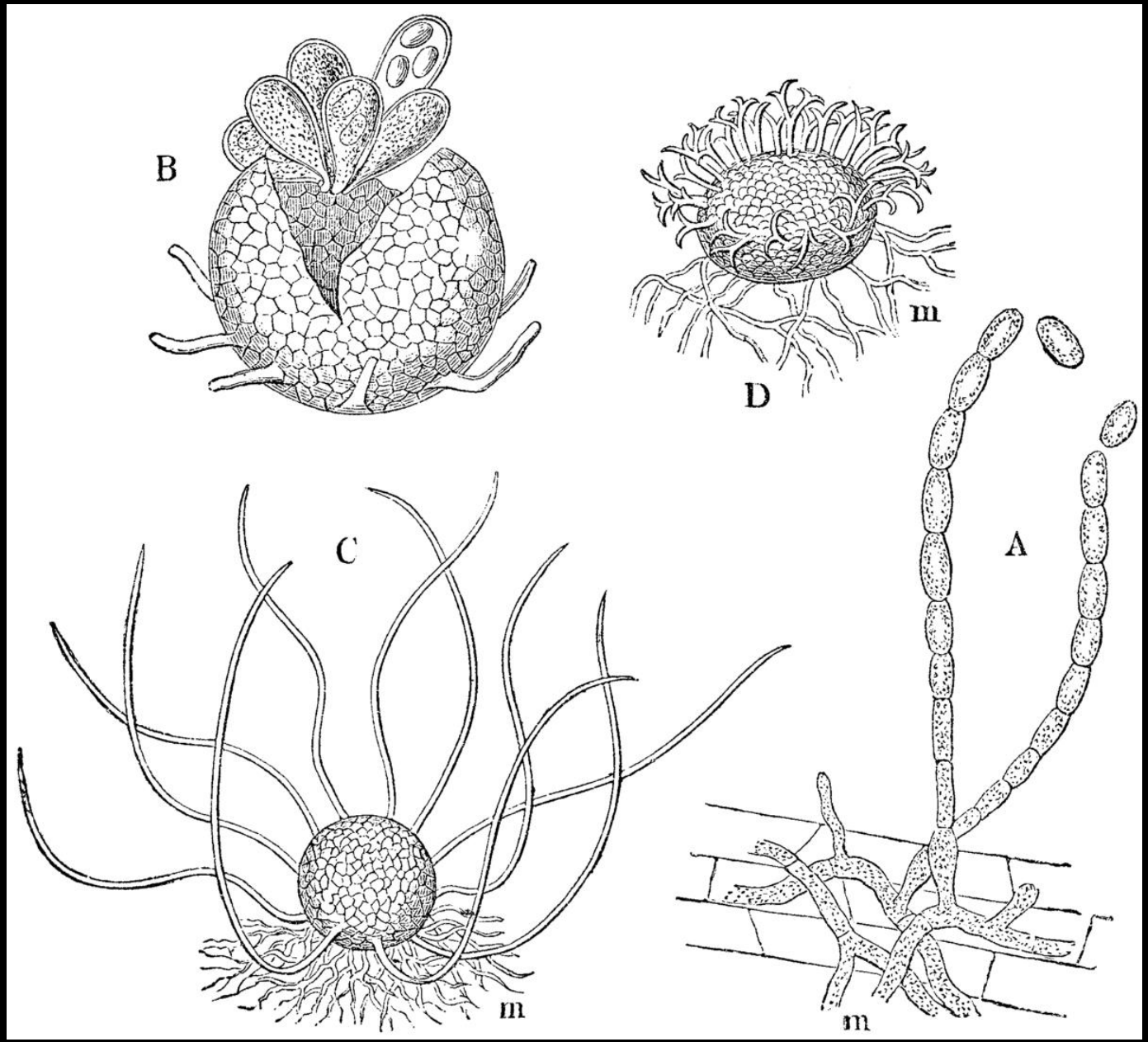
- Pathogen survives as cleistothecia in the crop debris in the field.

FAVOURABLE CONDITIONS

- High temperature (15-28 ºC)
- low humidity <60%
- low or no rainfall with wind






B
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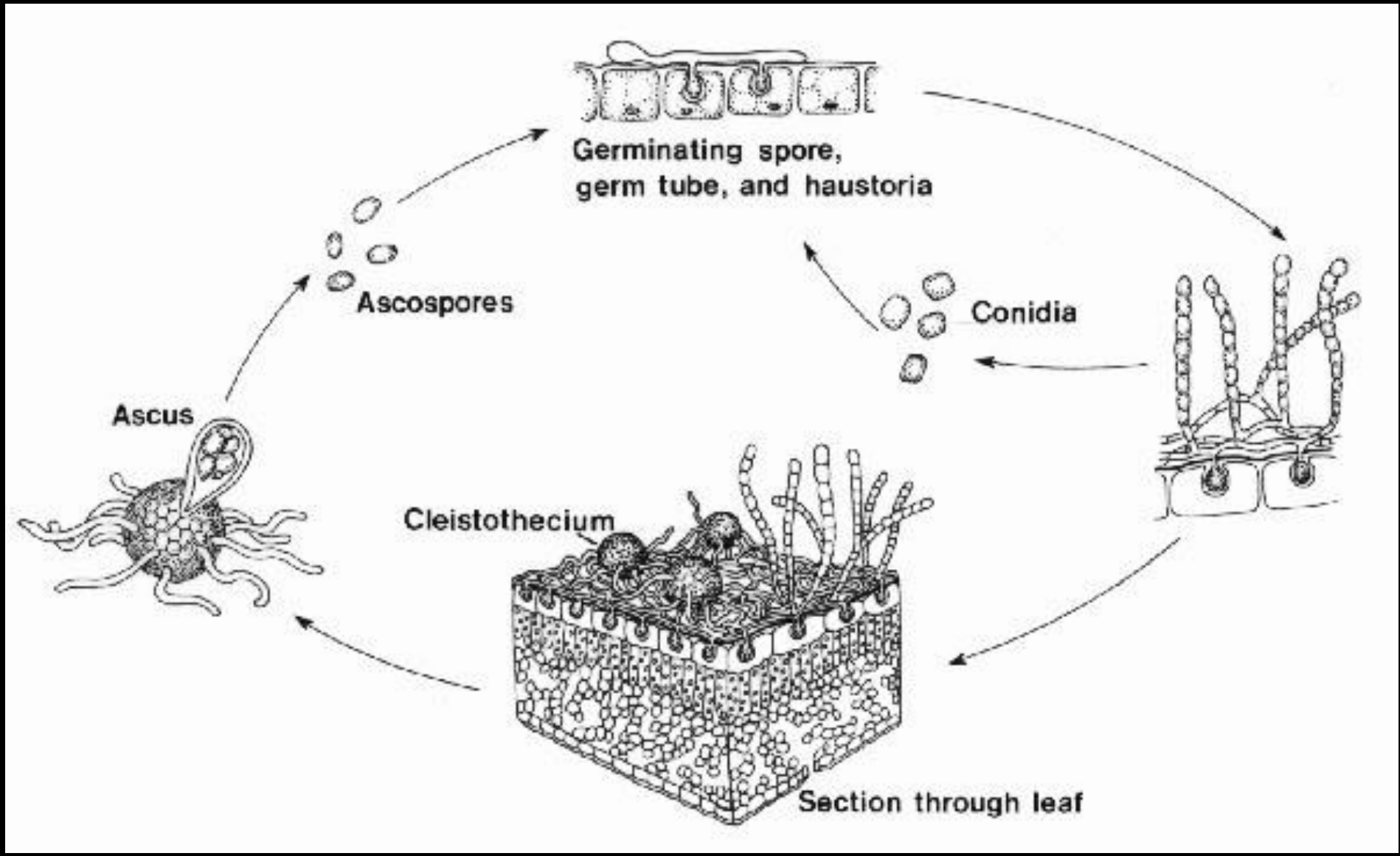
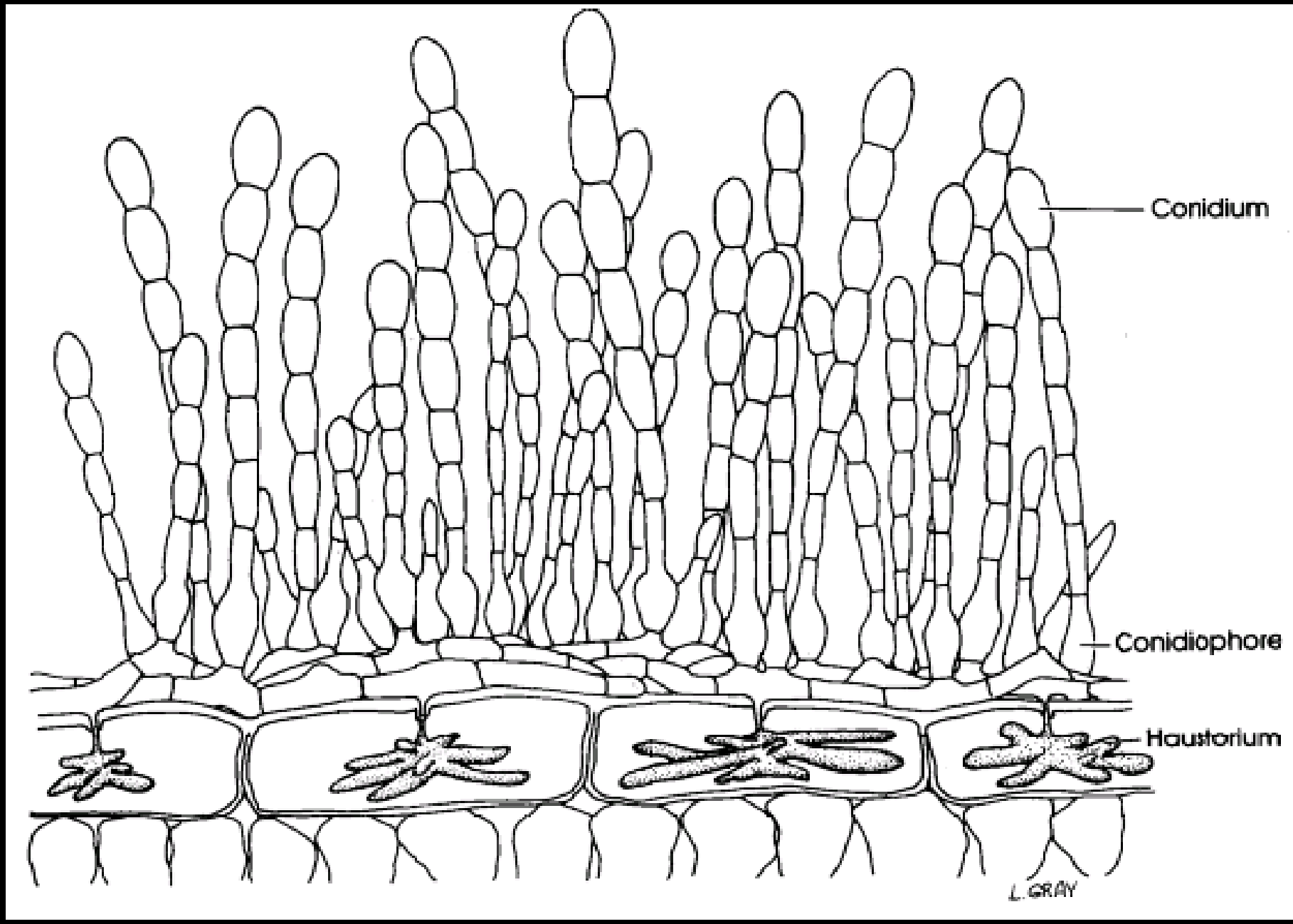
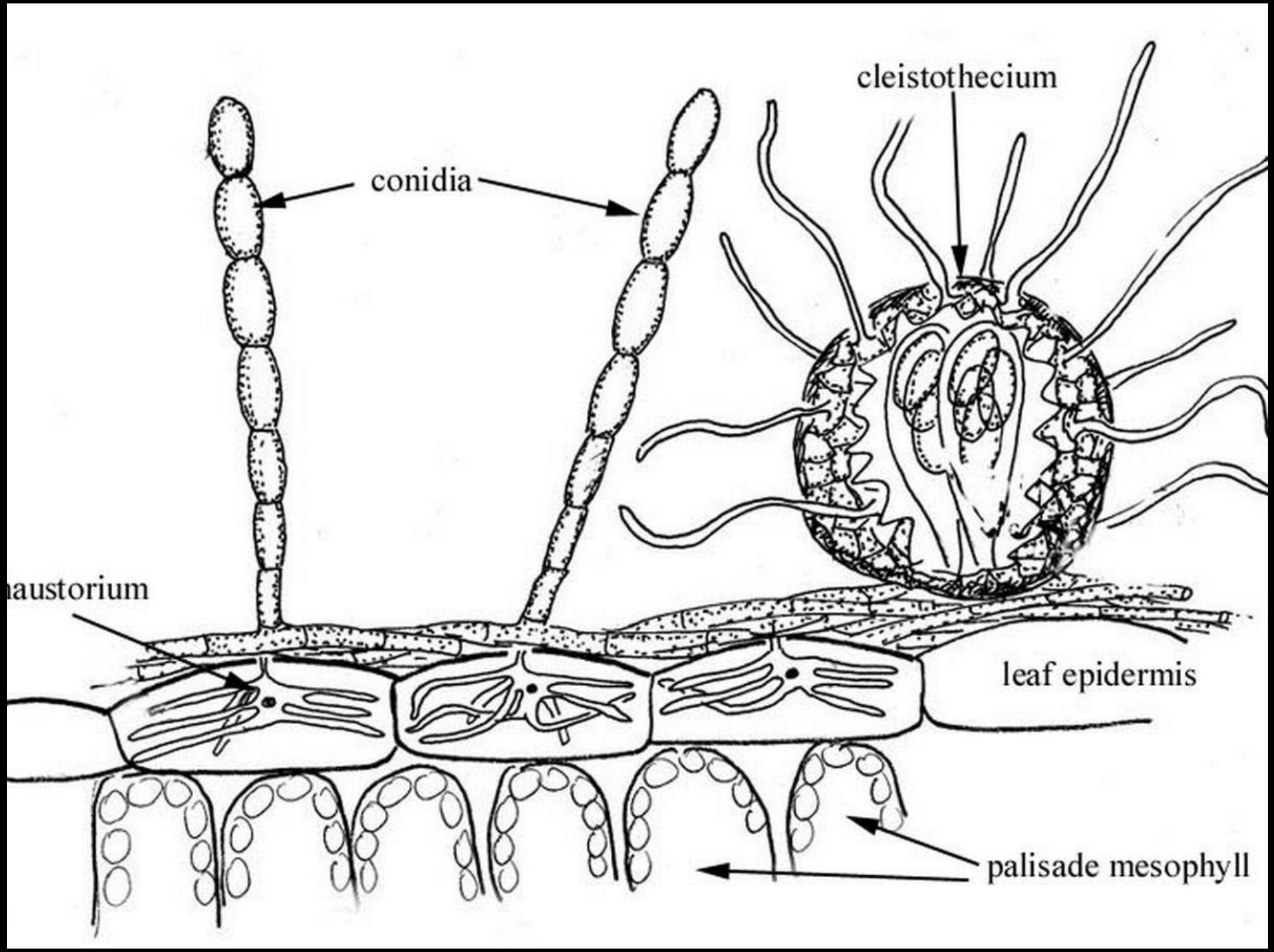

Germinating spore,
germ tube, and haustoria
Ascospores
Conidia
Ascus
Cleistothecium
Section through leaf


Conidium
Conidiophore
Haustorium
L. GRAY


cleistothecium
conidia
haustorium
leaf epidermis
palisade mesophyll

MANAGEMENT

- Plant resistant varieties-Uttara, Him Sarson 1 (ONK 1)
- Rotate crops
- Remove all crop debris after harvest
- Remove weeds
- Avoid excessive application of nitrogen fertilizer
- Spraying of wettable sulphur @ 2.5 g/ kg of seed/Karathane or Carbendazim @ 0.1 %

Myrothecium Leaf Spot

Pseudocercosporella capsellae (sexual stage: *Mycosphaerella capsellae*)

CLUB ROOT - *Plasmodiophora brassicae*

- Affected plants remain stunted.
- Tiny nodules to large club shaped outgrowths develop in root system.
- Leaves turn pale green or yellow followed by wilting.
- Under severe conditions the plants dies.

SURVIVAL AND SPREAD

- Pathogen survives in the soil as resting spores.

FAVOURABLE CONDITIONS

- Humid weather.
- High soil moisture.

MANAGEMENT

Plant only certified seed.
Applying lime to the soil can reduce fungus sporulation.

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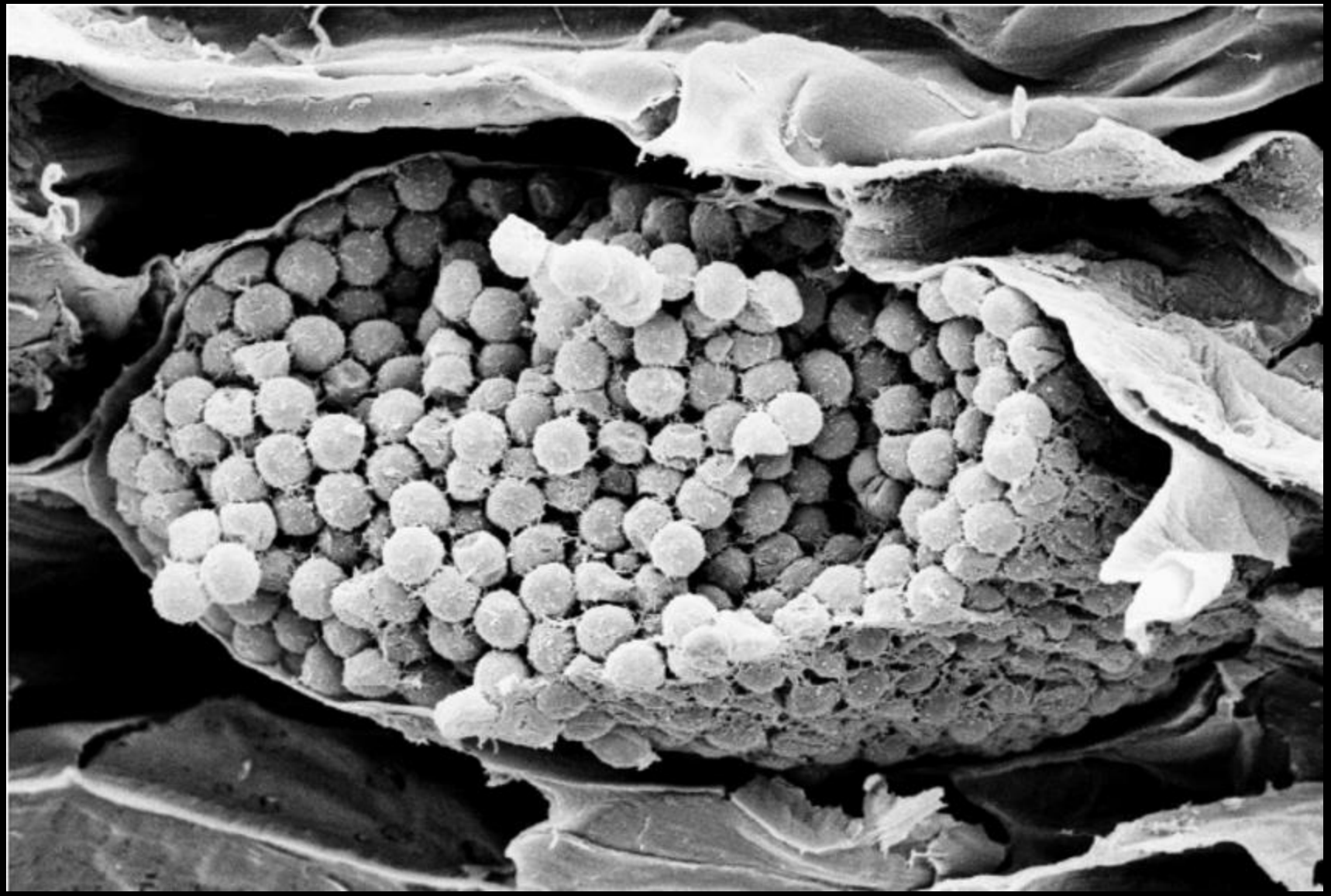
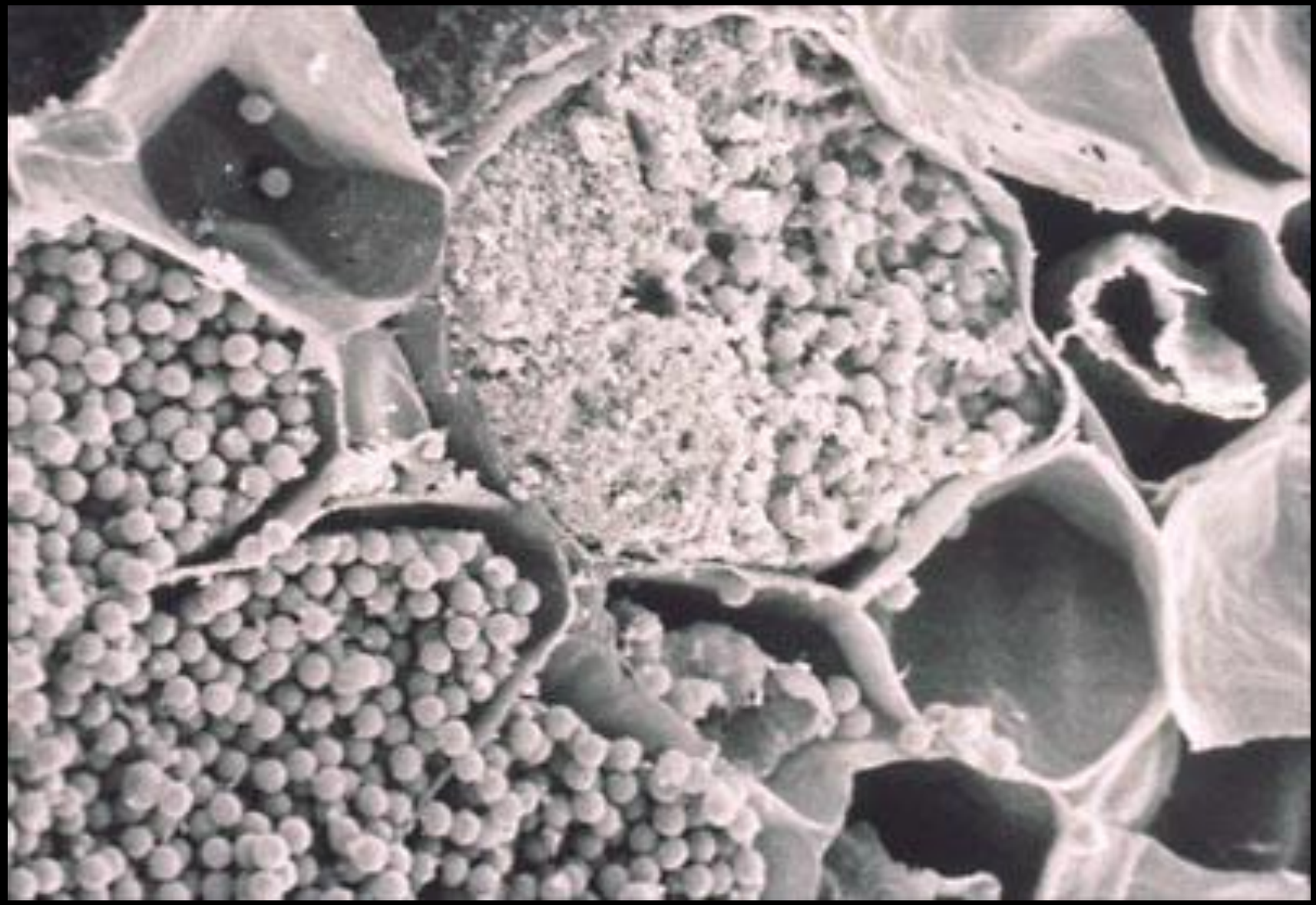
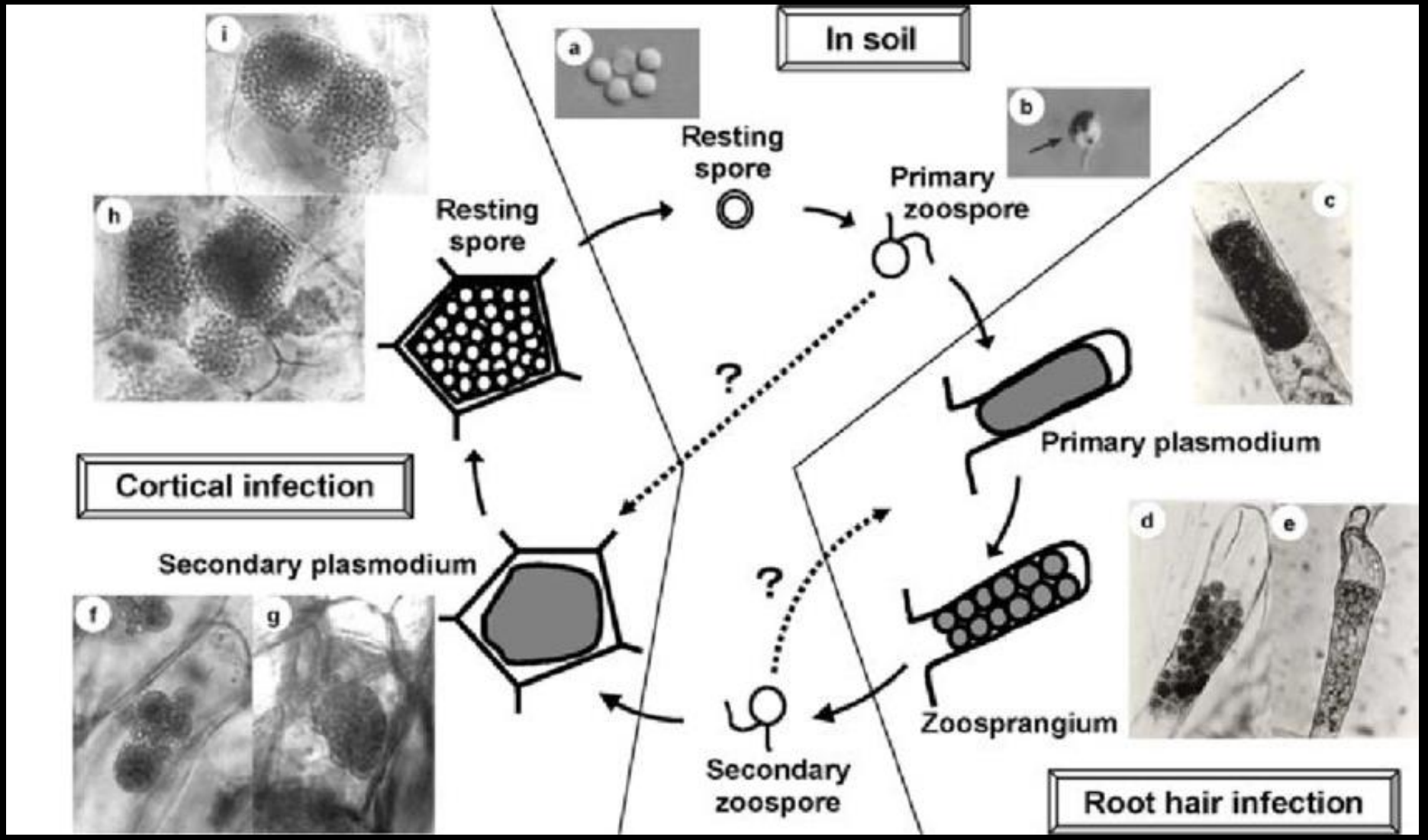


SEM photo of *Plasmodiophora brassicae* resting spores in infected roots of *Brassica rapa*

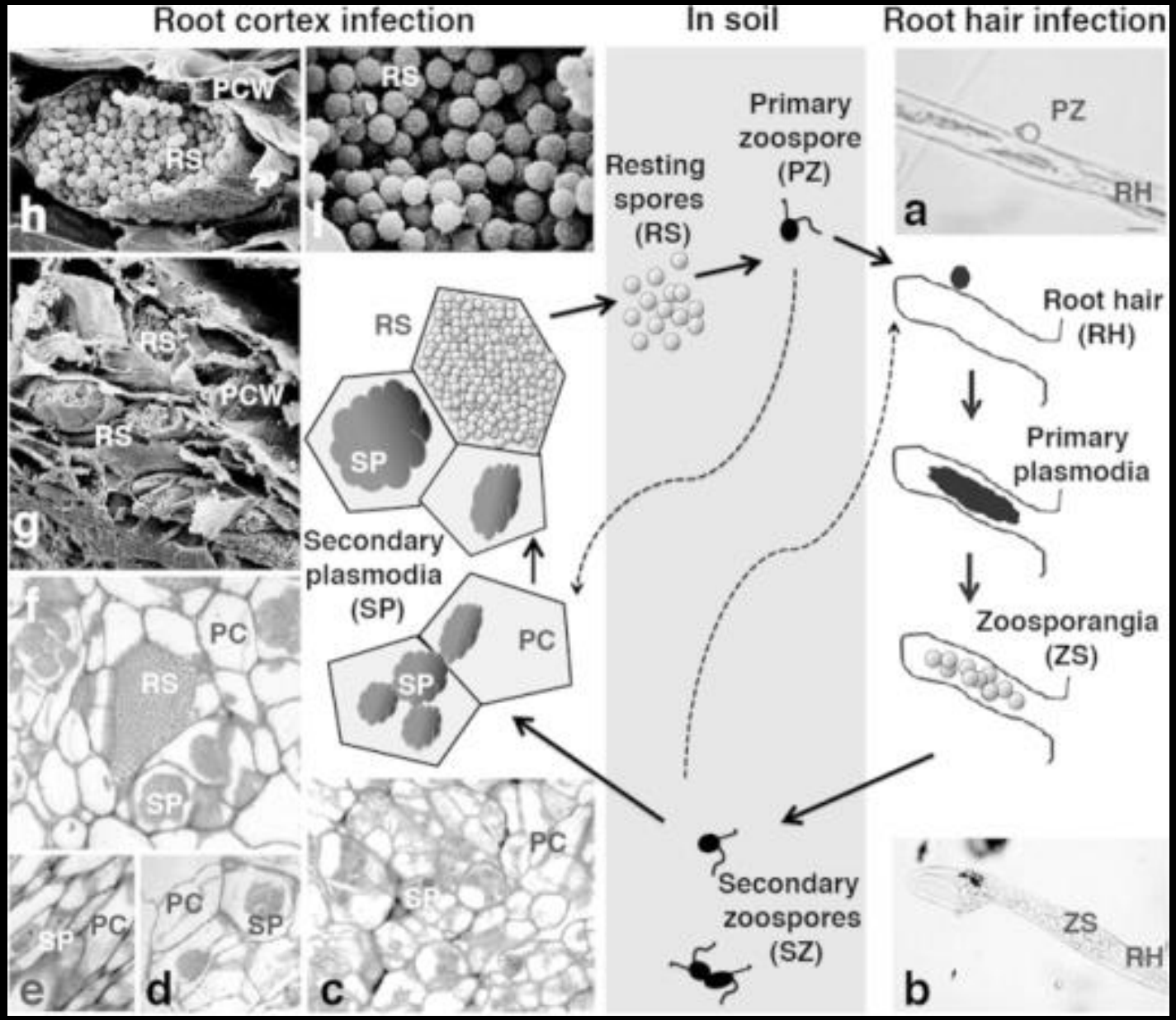


Plasmodium (pl. plasmodia) naked multinucleate mass of protoplasm moving and feeding in amoeboid fashion [SEM of plasmodia of *Plasmodiophora brassicae* undergoing differentiation to resting spores

Life cycle of *Plasmodiophora brassicae*



Life cycle of *Plasmodiophora brassicae*



SCLEROTINIA STEM ROT, WHITE MOLD- *Sclerotinia sclerotiorum*

- Elongated water soaked lesions appear on stem near to the crown region, covered with cottony mycelial growth later on.
- Premature ripening and shredding of stem, wilting and drying.
- Brown to black sclerotial bodies may also be seen in the later stage on the infected plant parts.

SURVIVAL AND SPREAD

- The pathogen survives as mycelium in dead or live plants
- As sclerotia in infected plant parts or on the soil surface or with seed as contaminant.

FAVOURABLE CONDITIONS

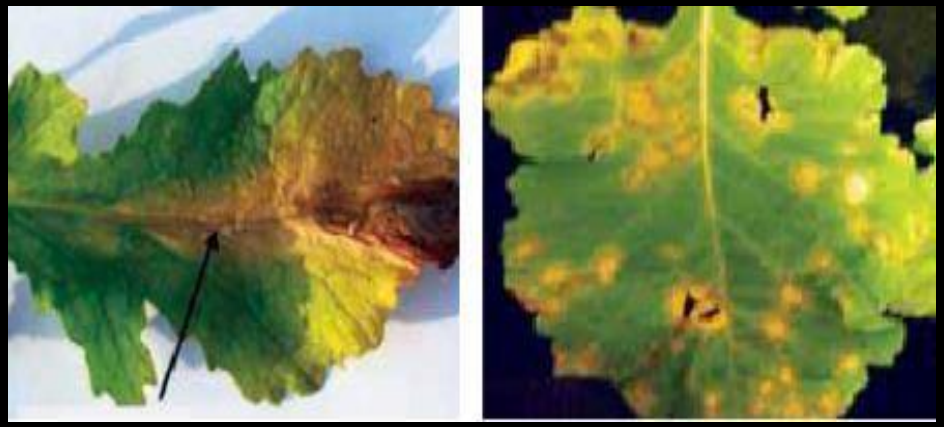
- High humidity (90-95%)
- Average temperature (18-25 ^{o}C) along with wind current.

MANAGEMENT

- Use crop rotation
- Plant thoroughly cleaned seed. Avoid dense stands of canola.
- Resistant varieties - Him Sarson 1 (ONK 1)
- Spraying Azoxystrobin @ 0.1 per cent

BACTERIAL BLIGHT/BLACK ROT - *Xanthomonas campestris* pv *campestris*

- The leaf tissue turns yellow and chlorosis,reach towards the centre of the leaf and form V shaped area.
- The veins show brown to black discoloration.
- Dark coloured streaks are formed on the stem from the ground level and gradually these streaks enlarge and girdle the stem.Stem become hollow due to internal rotting.
- Midrib cracking of lower leaves, browning of veins and withering is observed.
- In severe cases, the vesicular bundles of the stem also turn brown and the plant collapses.



SURVIVAL AND SPREAD

- The pathogen survives in infected plant residue in soil and seed.
- The pathogen spreads by soil and irrigation water.

FAVOURABLE CONDITIONS

- Warm and humid climate favours the disease development

MANAGEMENT

- Use good sanitation practices
- Rotate crops to non-cruciferous crops every 2
- Spraying Streptomycin sulphate @ 0.05 %

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DISEASES OF JATROPHA

Cercospora leaf spots: *Cercospora* sp.

Cercospora jatrophicola (Speg.) Chupp,

Cercospora jatrophigena U. Braun

Pseudocercospora jatrophae-curcas (J.M. Yen) Deighton

Pseudocercospora jatrophae (G.F. Atk.) A.K. Das & Chattopadh.

Pseudocercospora jatropharum (Speg.) U. Braun

Leaf Spot: *Alternaria ricini*

Anthracnose: *Colletotrichum gloeosporioides* (Penz.) Sacc.

***Colletotrichum capsici* (Syd.)Butl.and Bisby**

Dieback / Stem canker: *Lasiodiplodia theobromae*

Rust : *Melapsora ricini, Phakopsora arthuriana , Uredo jatropicola*

Powdery mildew: *Pseudoidium jatrophae* (Braun & Cook 2012)

Fusarium wilt: *Fusarium oxysporum*

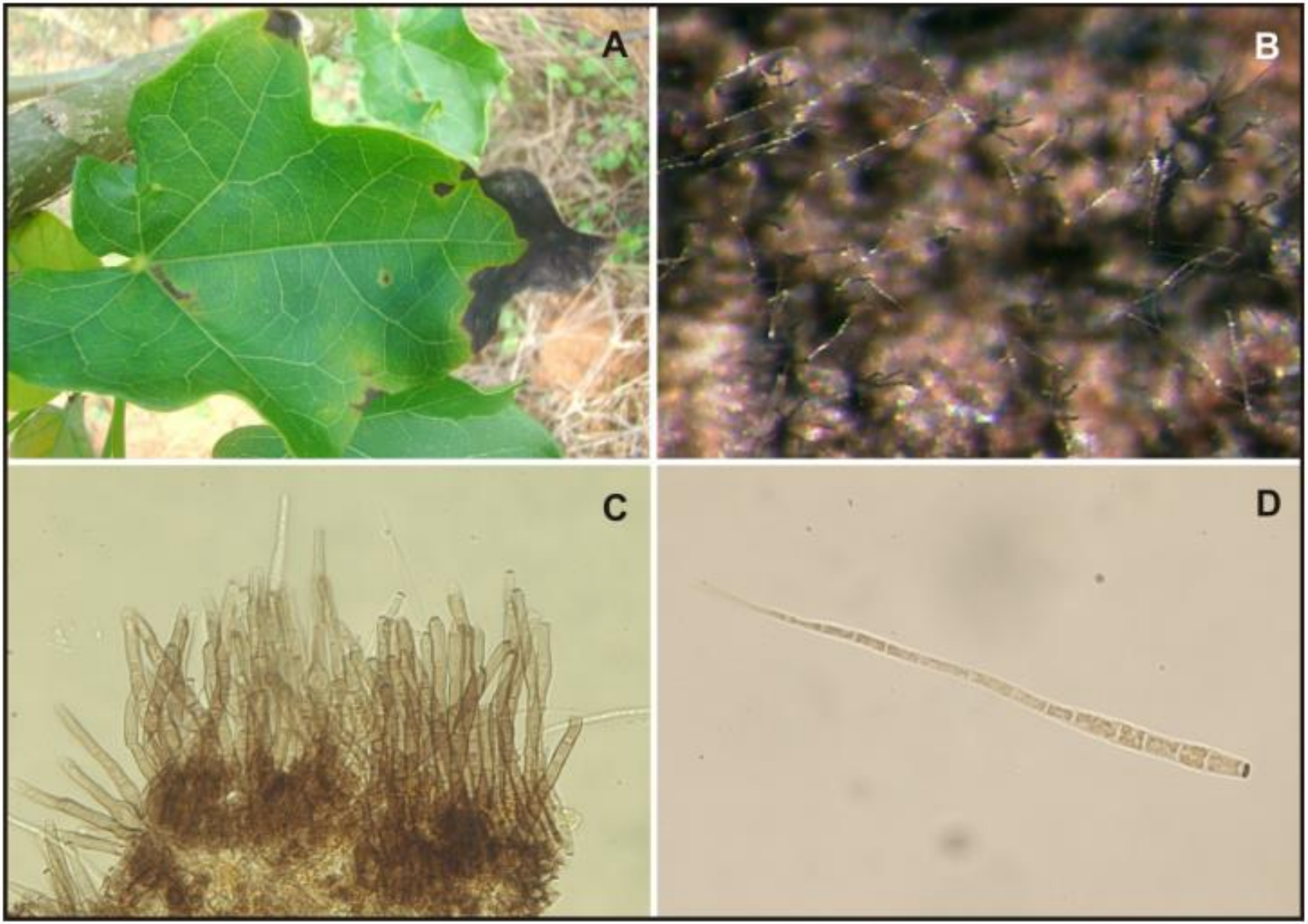
Collar rot / root rot: *Macrophomina phaseolina*

Botrytis rot*: Botrytis ricini*

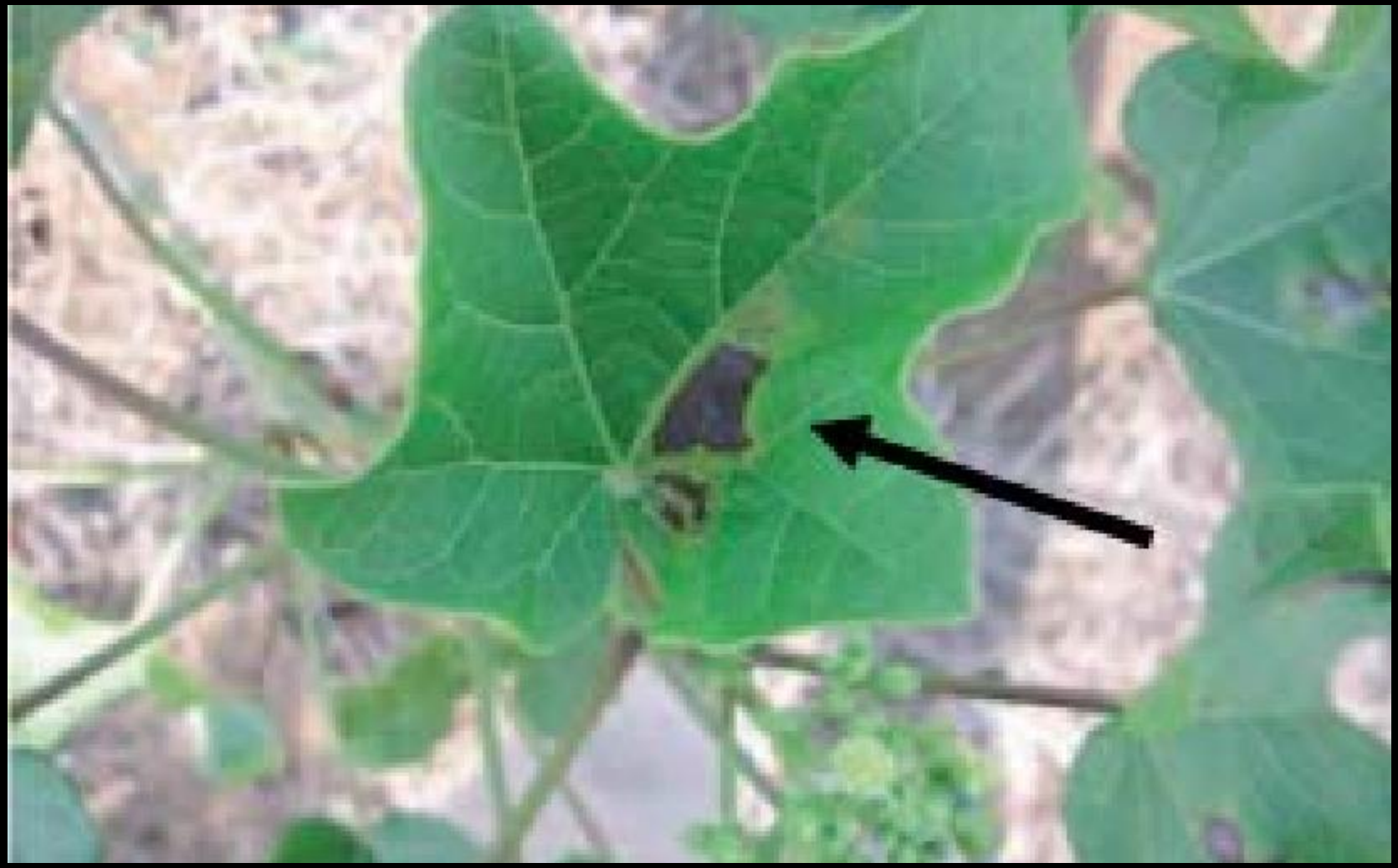
Bacterial Spot: *Xanthomonas ricinicola*

Cercospora leaf spots : *Cercospora* sp.

The form of leaf spot was irregular. The leaf spot was whitish brown in the center with brown at the edge. The spot was a necrotic tissue that was encircled by chlorotic tissue seen as yellowish zone

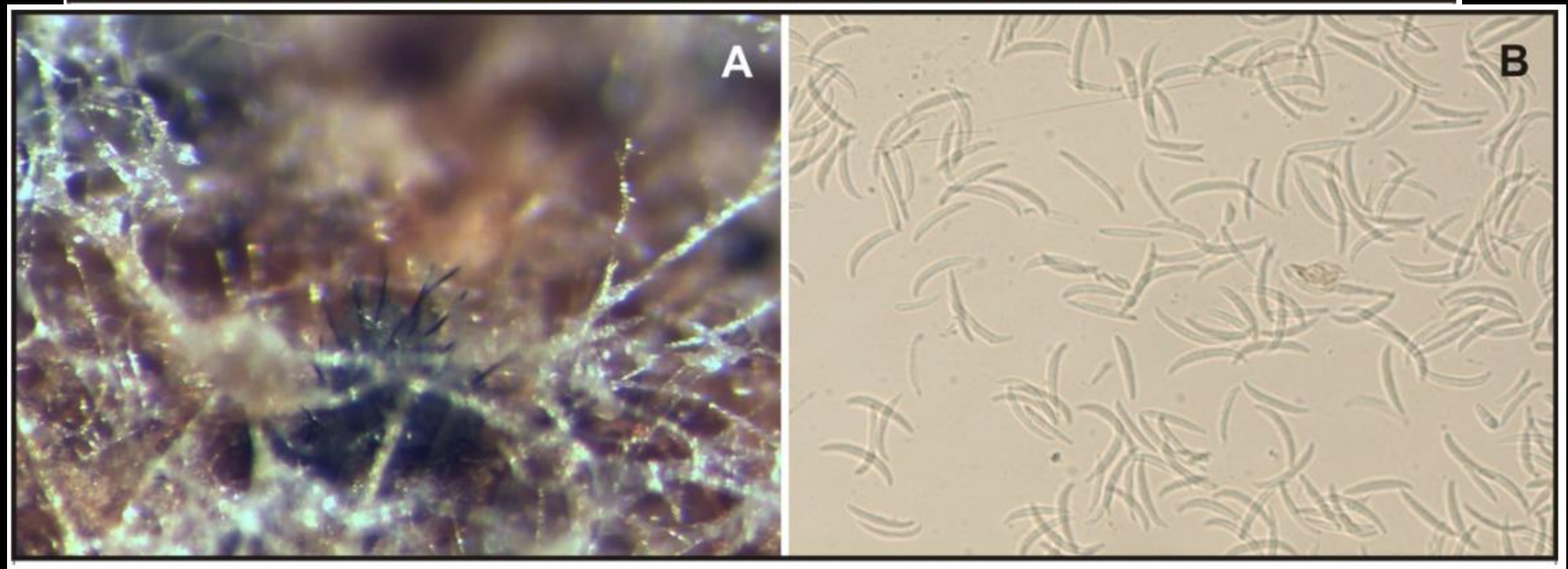

A
B
C
D

Leaf Spot: *Alternaria ricini*



The symptoms of this disease are similar to that of *Cercospora* leaf spot except that all spot areas are brown in color without whitish area

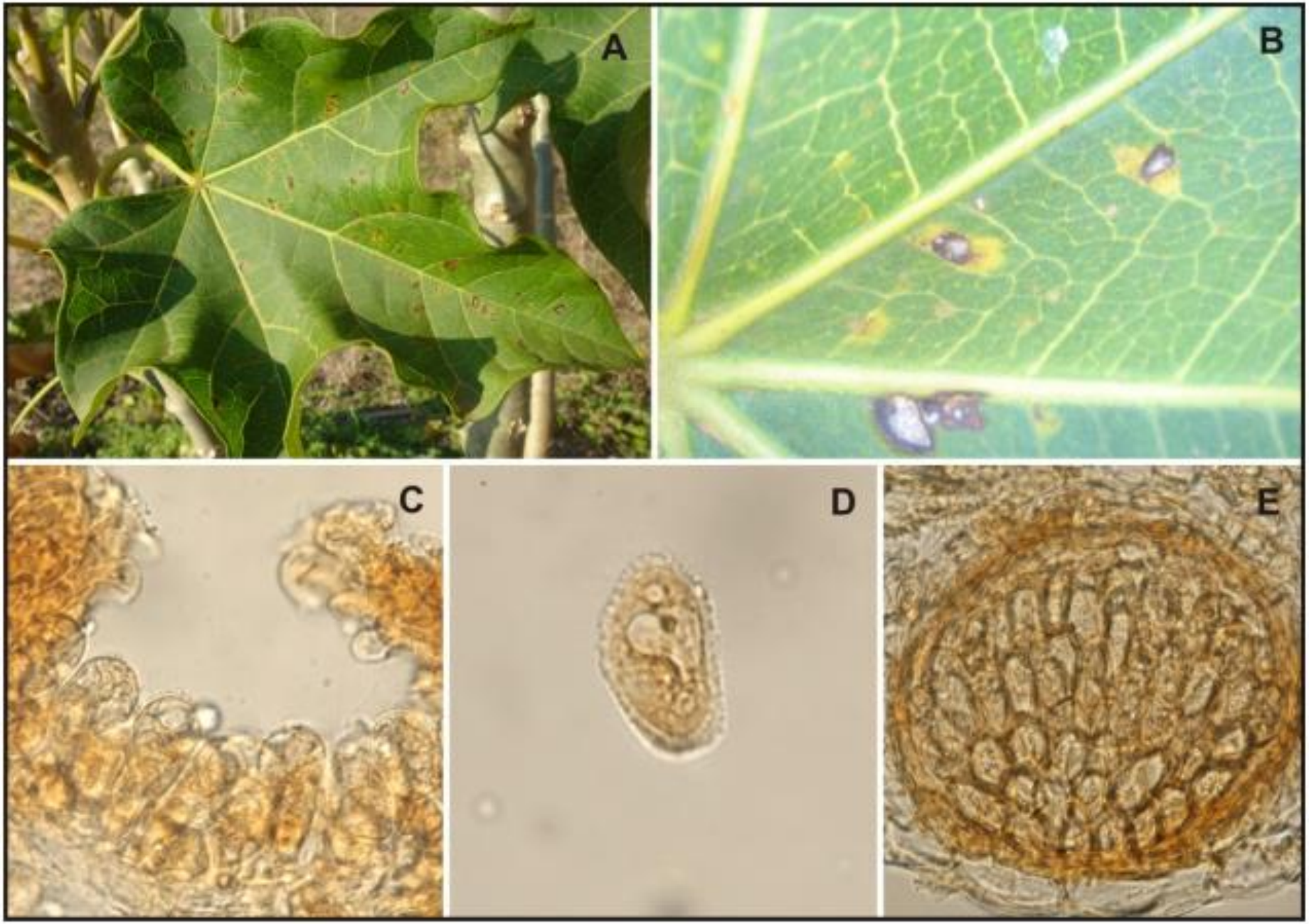
Anthracnose - *Colletotrichum capsici*



Anthracnose - *Colletotrichum capsici*

Rust: *Phakopsora jatrophicola* (Arthur) Cummins (= *Phakopsora arthuriana* Buriticá & J. F. Hennen)

Initial symptoms include small, brown, rusty pustules on the lower surface of the leaf accompanied by yellowing on the corresponding upper surface. The pustules later coalesce, leading to drying of the entire leaf.


A
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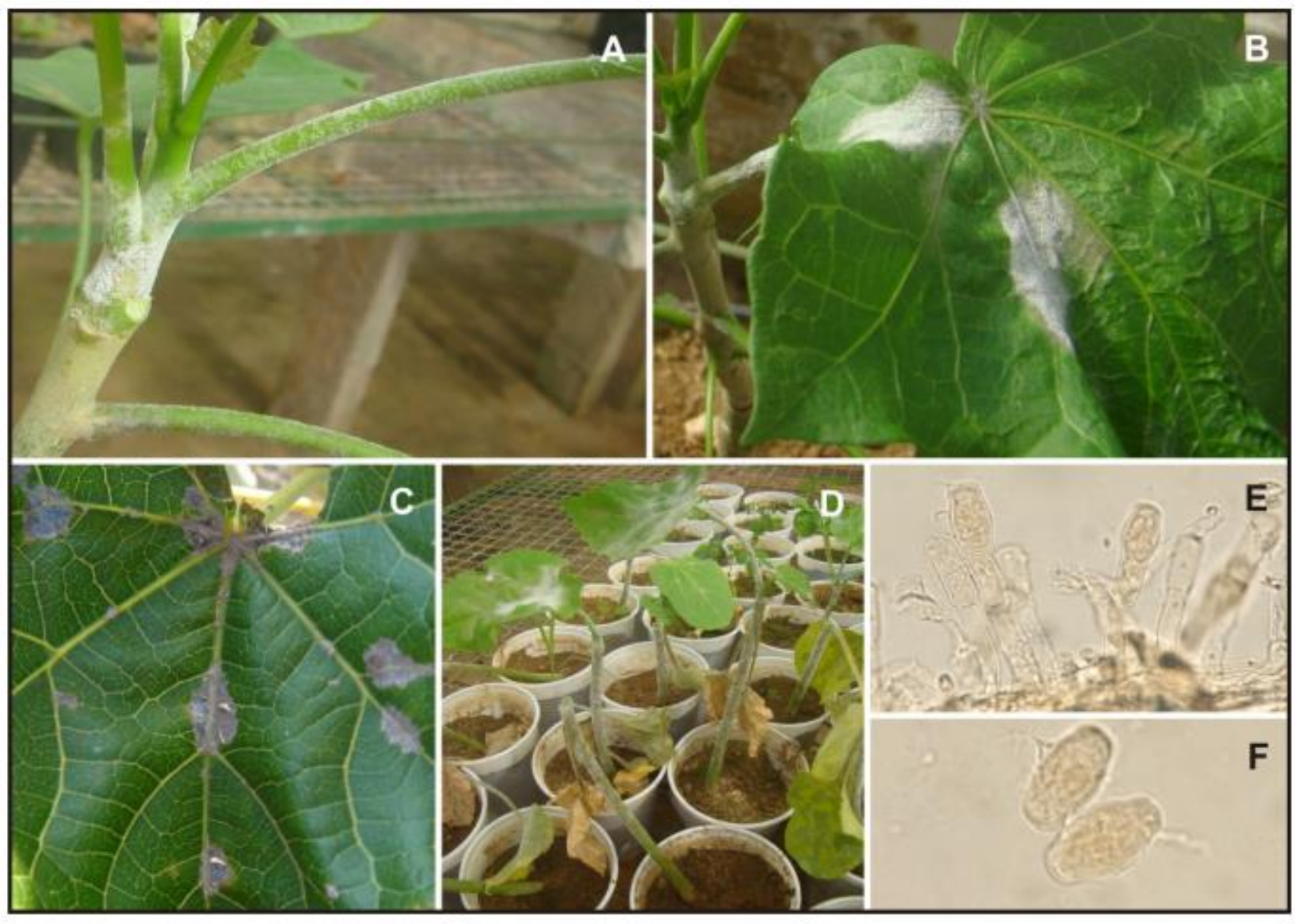
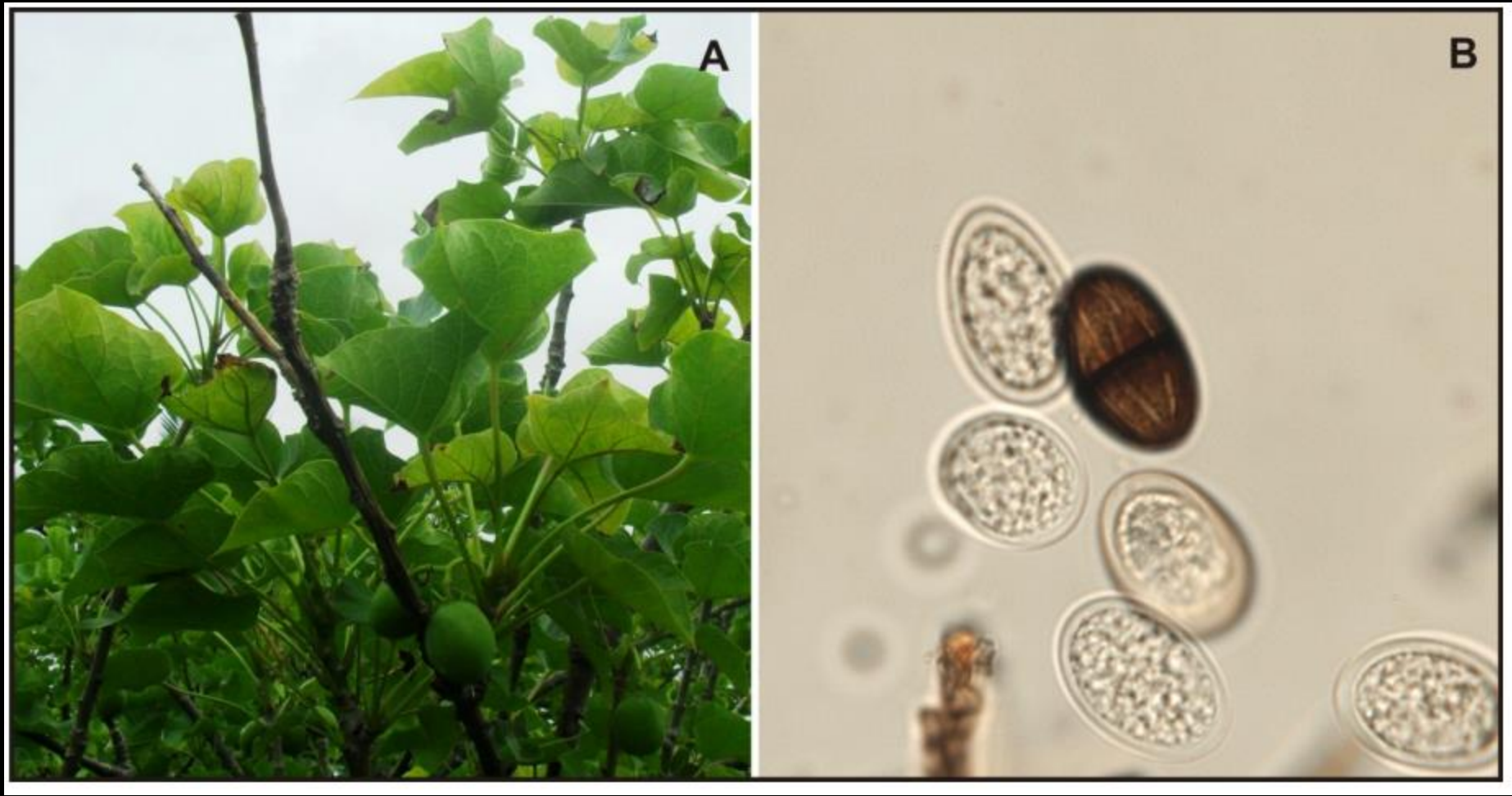
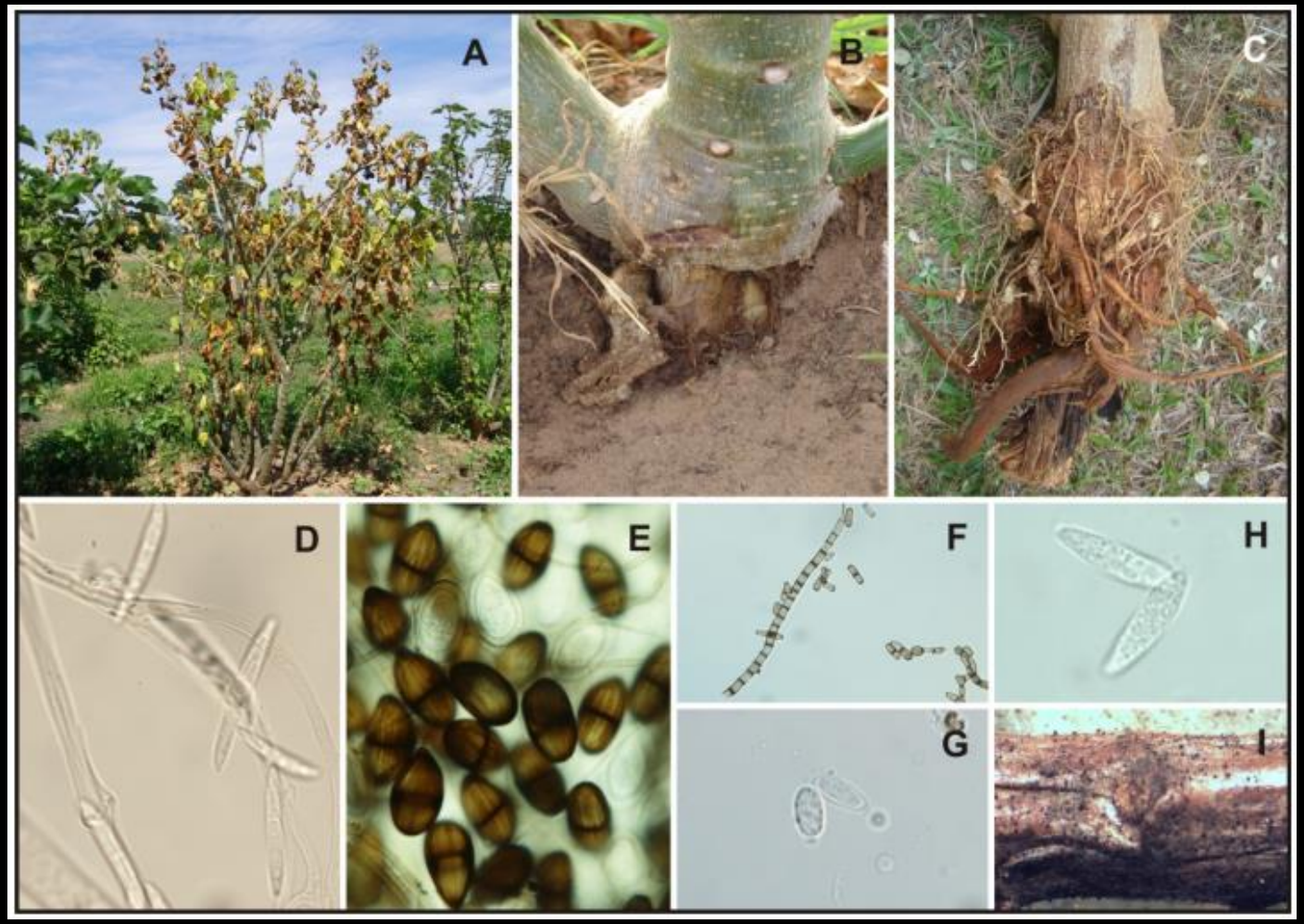
Powdery mildew: *Pseudoidium jatrophae*

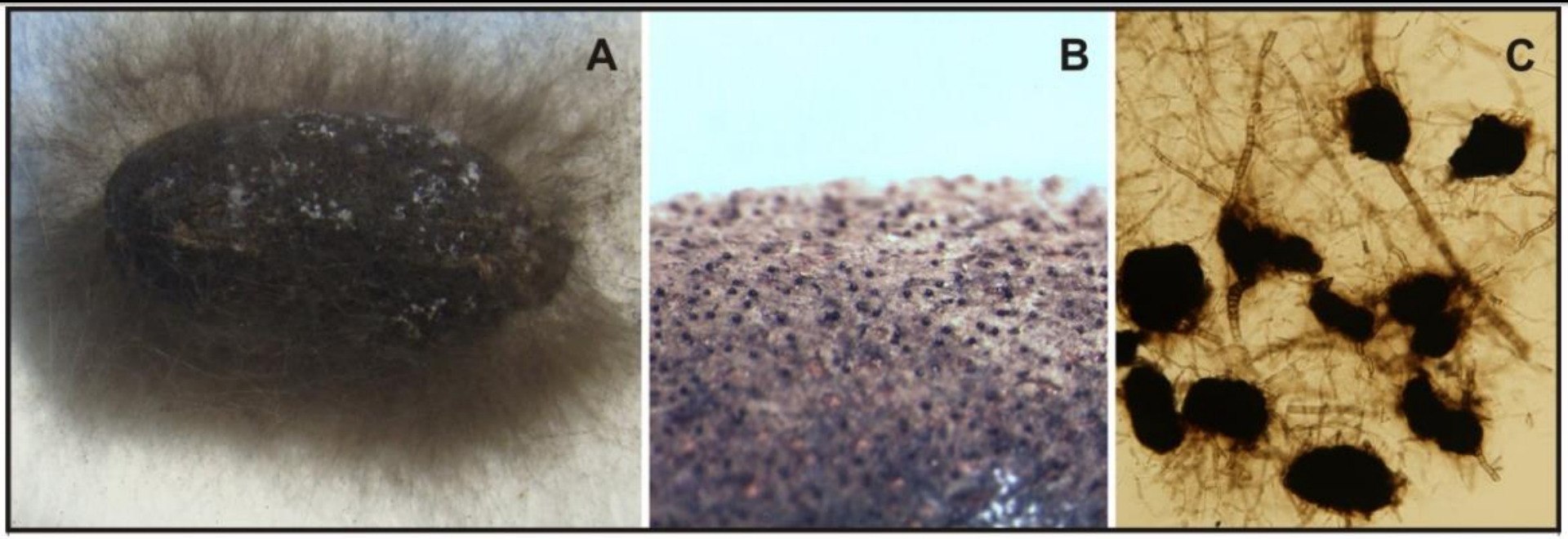


Dieback : *Lasiodiplodia theobromae*



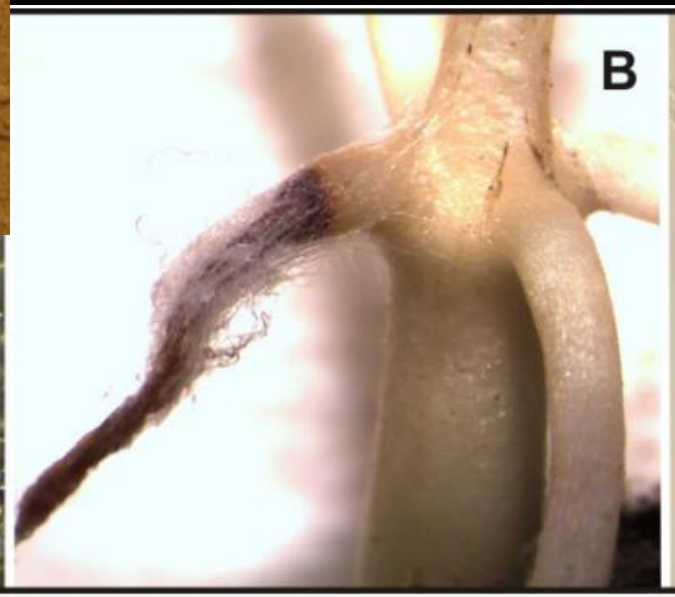


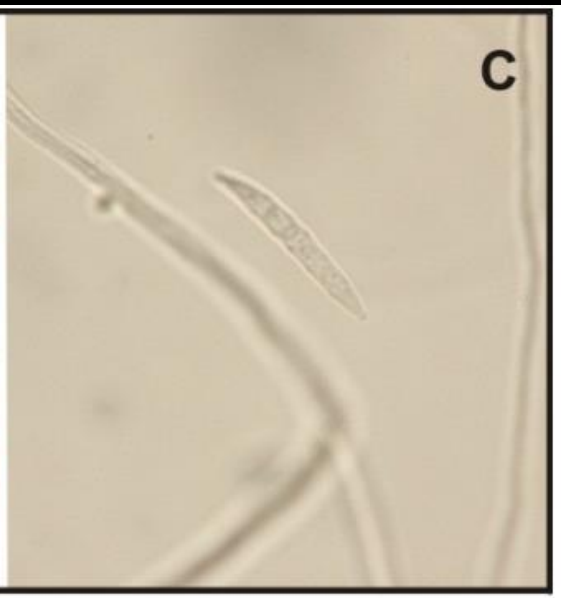
Collar and root rot on Jatropha curcas. Wilting symptoms observed in the field (A);Detail of the collar rot (B); Detail of root rot (C);Macroconidia of *Fusarium solani* (D); Pigmented and hyaline conidia of *Lasiodiplodia theobromae* (E); Arthroconidia of *Neoscytalidium dimidiatum* (F); *Fusicoccum*- like conidia of *Neoscytalidium dimidiatum* (G); Conidia of *Macrophomina phaseolina* (H). Sclerotia of *Macrophomina phaseolina* produced on sterilized Pine twigs in culture (I).



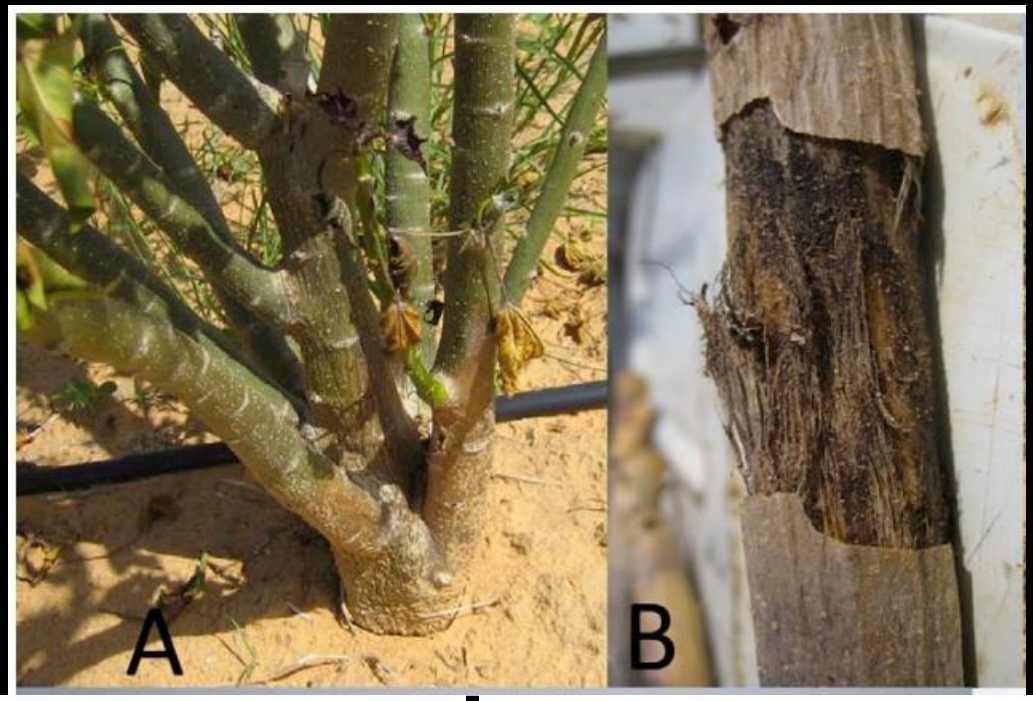
***Macrophomina phaseolina* on *Jatropha curcas* seed. Seed covered by mycelium (A); Detail of sclerotia on seed (B);Black sclerotia (C).**

Fusarium wilt: *Fusarium oxysporum*





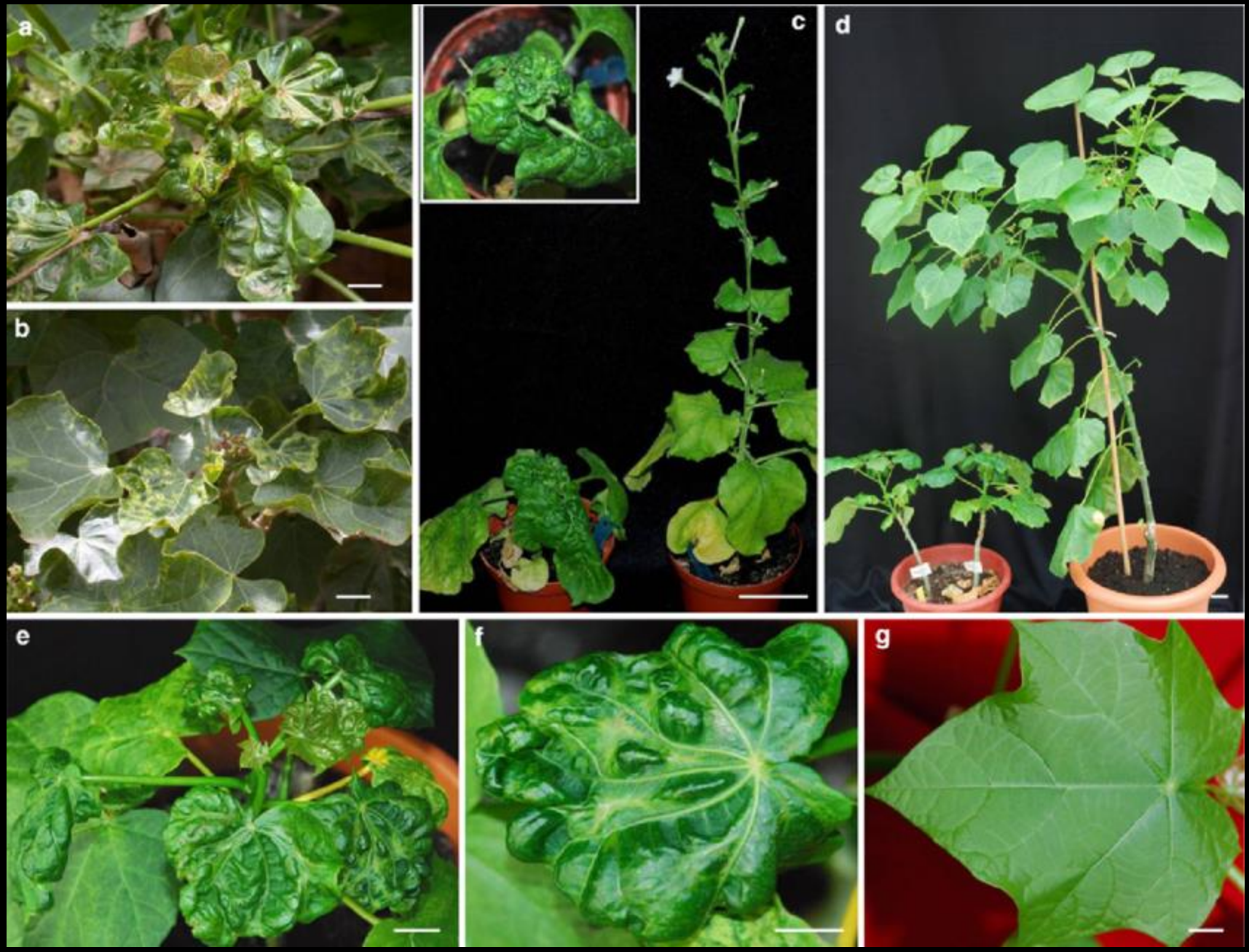
Collar rot / root rot: *Macrophomina phaseolina*


A
B


C

Jatropha Mosaic


a
b


a
b
c
d
e
f
g


A
B

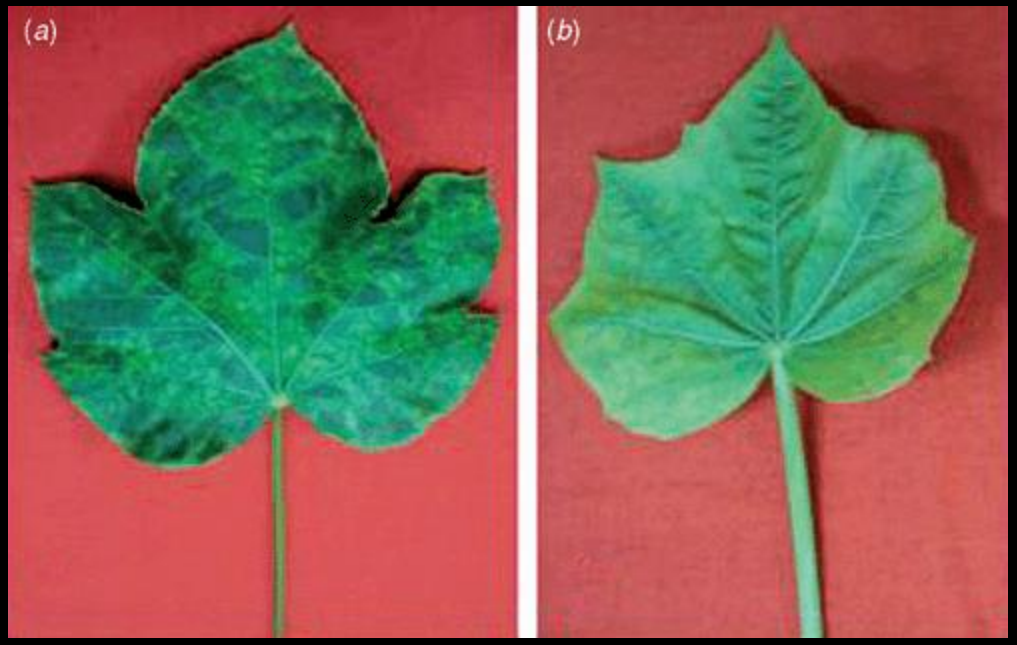
Jatropha mosaic India virus

Figure 4: Different type of symptoms on infected *J. curcas* leaves (a) Initiation of mosaic (b) Mild mosaic (c) Mottle-mosaic (d) Severe mosaic and distortion of leaf (e) Crinkling and vein swelling (f) Yellow patches.

Figure 1: Jatropha species grown in India: (A) *Jatropha curcas*, (B) *J. multifida*, (C) *J. gossypifolia* Red leaf, (D) *J. gossypifolia* Green leaf, (E) *J. integerrima* and (F) *J. podagrica*.

Figure 3: A field view showing natural infection and showing various type symptoms on Jatropha species (a) *J. curcas* (b) *J. gossopifolia (Red species)* (c) *J. gossopifolia (Green species)* (d) *J. multifida* (e) *J. Podagrica* (f) *J. integrrima*.

J. curcas showing mosaic symptoms on a naturally infected leaf (_a_) as compared with a whitefly-inoculated leaf (_b_)



Croton yellow vein mosaic virus


a
b