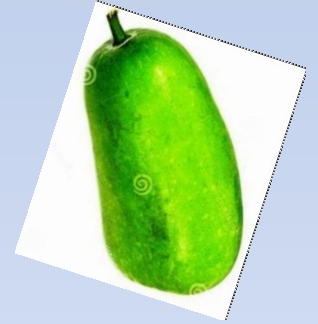


CUCURBITS



Important diseases of Cucurbits

1. Fusarium wilt
2. Root rot
3. *Verticillium* wilt
4. Anthracnose
5. Powdery mildew
6. Downy mildew
7. *Cercospora* leaf spot
8. *Alternaria* leaf spot
9. Scab
10. Fruit rot
11. Bacterial wilt
12. Angular leaf spot
13. Cucumber mosaic
14. Ring spot

Minor diseases

- a) Seed decay & seedling blight
- b) Gummy collar rot
- c) *Diplodia* leaf spot
- d) Bitter gourd mosaic
- e) Bottlegourd mosaic
- f) Ribbed gourd mosaic
- g) Snake gourd mosaic
- h) Squash mosaic
- i) Yellow mosaic
- j) Cucumber green mottle mosaic
- k) Yellow vein mosaic
- l) Vein banding of watermelon
- m) Phyllody of chowchow
- n) Cucurbit phyllody
- o) Witches' broom

1. Fusarium wilt

Fusarium oxysporum f.sp. *niveum* (watermelon)

Fusarium oxysporum f.sp. *melonis* (muskmelon)

Fusarium oxysporum f.sp. *cucumarinum* (cucumber)

Fusarium oxysporum f.sp. *laginariae* (Bottle gourd)

Fusarium oxysporum f.sp. *momordicae* (Bitter gourd)

Etiology:

The fungus produces three types of spores.

Microconidia are small, colourless, oval to narrowly elliptical and non-septate. **Macroconidia** are large, sickle-shaped, septate. **Chlamydospores** are thick walled.

Symptoms:

- Affects at **all stages**.
- Seedlings, may **damp-off and die** or the **cotyledons** may **wilt** and seedlings become **stunted**.
- Older plants wilt quickly, severely and permanently and they **die within 10 days**.
- Inside wilted stems, **the vascular tissue** is discoloured.
- In a wet weather, a **white or pinkish fungus growth** develops on the surface of dead stems.
- In advanced stages, **roots decompose**.



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Mode of spread and survival:

- The pathogen survives in **soil** up to **16 years** and **on seeds**.
- The fungus spreads **in soil, compost and manure**.
- Carried by **water, tools, machinery** and **feet of workers and animals**.
- The thick walled **chlamydospores** are the resting spores of the fungus that persist in the **field soils**.


Epidemiology:

- Root-knot nematodes** increases the incidence.
- The optimum temperature for infection and disease development is **27°C to 30°C**.
- Disease development is favoured by **high nitrogen, low calcium and low potassium levels**.
- High **nitrogen** levels **increase susceptibility** plants.

Management:


- Disease free seeds should be used.
- Crop rotation with other crops for at least two years.

Plough down crop residues after harvest.

 Fumigation with Methyl bromide plus Chloropicrin or Vapam are useful.

 Use disease resistant varieties.

 Seed treatment with *Trichoderma viride* (4g/kg) and soil application of *T. viride* (2.5kg/ha)

 High potassium levels appear to increase the activity of beneficial competitive fungi around roots.

2.Root rot

Etiology:

Pythium irregulare, *P ultimum* (watermelon, squashes & Cucumber),

Pythium aphanidermatum (Muskmelon)

Fusarium oxysporum f.sp, *cucurbitae* (Pumpkin & squashes).

Symptoms:

➤ **Dwarfing**, production of yellow leaves, **wilting**, **failure** of fruit set and **complete** collapse of the plant.

➤ The roots appear **water soaked** and plants become **flaccid**. Sunken, darkened lesions seen on **the larger, fleshy roots**.

contd...

➤ The crown becomes **girdled** and the top is easily pulled out.

➤ **Fruits** on the ground may be **rotten** by the fungus.









Mode of spread and survival:

Seeds from infected fruits can **carry the fungus** on their surface.

Management:

 ***Pythium*** root rot can be controlled by rotation with **cereals, crucifers and lettuce**.

 The disease can be minimized by **soaking** the seeds in **Mercuric chloride** 0.1 % solution for 15 min.

4. Verticillium wilt

Etiology: *Verticillium albo-atrum* and *V. dahliae*

Conidiophores are abundant, more or less erect, hyaline, verticillately branched and 2 to 4 phialides arising at each node.

Conidia arise singly, ellipsoidal to irregularly sub-cylindrical, hyaline, aseptate or 1-septate.

Symptoms:

- Marginal **yellowing** and **drying** which proceeded from one margin to the other.
- Leaves become **yellow** from the base of the plant upwards and the whole **plant wilts**.
- If the stem is cut open **longitudinally, brown** discolouration of the wood can be seen.



Verticillium Wilt



Muskmelon



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Anthracnose

Etiology: *Colletotrichum lagenarium* (*Glomerella cingulata*).

Mycelium is septate, hyaline when young and dark when old.

Acervuli are brown to black , **Setae** are brown, thick walled, 2 to 3-septate.

Conidia are hyaline, oblong to ovate, single celled.

Symptoms:

- Small **yellowish or water soaked** areas are seen on the leaves, which becomes **rough and circular**.
- Enlarge rapidly and turn **brown** in most cucurbits.
- But **black** in watermelon.
- **Centre** of the lesion **may crack or drop** out giving **short hole** appearance.

- Petioles are also infected and defoliation of vines occur.
- On fruits, circular, black and **sunken cankers** appear.
- Under **humid conditions**, the lesions are covered with **pink spore** masses.
- The fruits of **watermelon or muskmelon** with a large number of lesions is usually **bitter**.
- The fruit may ripen but the **flesh is tough and insipid** (tasteless, odourless).











Mode of spread and survival:

- The fungus is **soil-and seed-borne** (seed coat).
- They overwinter in debris for a period of **5 years** and can survive in **cucurbit weeds**.
- The spores are carried by running **water, splashed rain, workers and the insect**.

Epidemiology:


Optimum temperature for germination is between **22 and 27°C**. Disease development is favoured by **20 to 30°C** and **100 % RH**.

Management:


 Removal and destruction of **infected plant** materials.


 Two year **crop rotation**.

 Use resistant varieties.

 Hot water treatment of seeds at **57.2°C for 20 min** eliminates the inoculum on the cucumber seeds.

 Seed treatment with **Thiram** or **Carbendazim** or **Mancozeb** at 2 g/kg checks seed-borne infection.

 Spraying at weekly interval with **Carbendazim** 0.1 % or **Mancozeb** 0.2 % or **Copper oxychloride** 0.2 % or **Difolatan** 0.2 % or **Benomyl** 0.15 % is effective in controlling the disease.

 **Immersion** of healthy watermelon in water containing **120 ppm of chlorine** for 5 min prevents infection.

Powdery mildew

It attacks muskmelons, squash, cucumbers, gourds, and pumpkins.

Etiology: *Erysiphe cichoracearum* and *Sphaerotheca fuliginea*

In *Erysiphe cichoracearum* fungus produces **cleistothecia** (10-15 Asci). In each **ascus**, **ascospores** are two and are oval or subcylindrical.

Sphaerotheca fuliginea wont affect watermelon.

Pathogen produces **perithecia**. Each **Ascus** contains 8 **ascospores**.

Conidia are in chains with distinct **fibrosin** bodies, ellipsoid to barrel-shaped.

Symptom:

- Superficial, **powdery, greyish-white growth** on upper leaf surfaces, petioles, and even on main stems of the plants.
- Affected areas turn **yellow** then **brown and die**.
- In dry seasons, **powdery mildew** can cause premature leaf drop and **premature** fruit ripening.

Mode of spread and survival:

- **Perithecia** developed on left over cucurbit crop in isolated areas serve **as primary** inoculum.
- **Wild cucurbits harbour** the conidial stage of the fungus and release conidia.
- **Conidia** are dispersed by wind, thrips and other insects.








Epidemiology:


The disease is favoured by **sultry weather**, moderate temperature, reduced **light intensity** and succulent plant growth. The optimum temperature is **28°C**.

Management:

 Cucurbits are **sensitive to sulphur dust** and so it should not be used.

 Spraying with **Carbendazim 0.1 %** or **Thiophanate-methyl 0.1 %** or **Tridemorph** or **Benomyl 0.1 %** or **Dinocap 0.05 %** or gives good control.

 Destruction of all diseased plants.

 **Weeds** harbouring the pathogen should also be destroyed.

 Use **resistant** varieties.

Downy Mildew

It occurs on cucumbers, squash, muskmelons, and pumpkins and less frequently on watermelons.

Etiology: *Pseudoperonospora cubensis*

Pathogen is an **obligate parasite**.

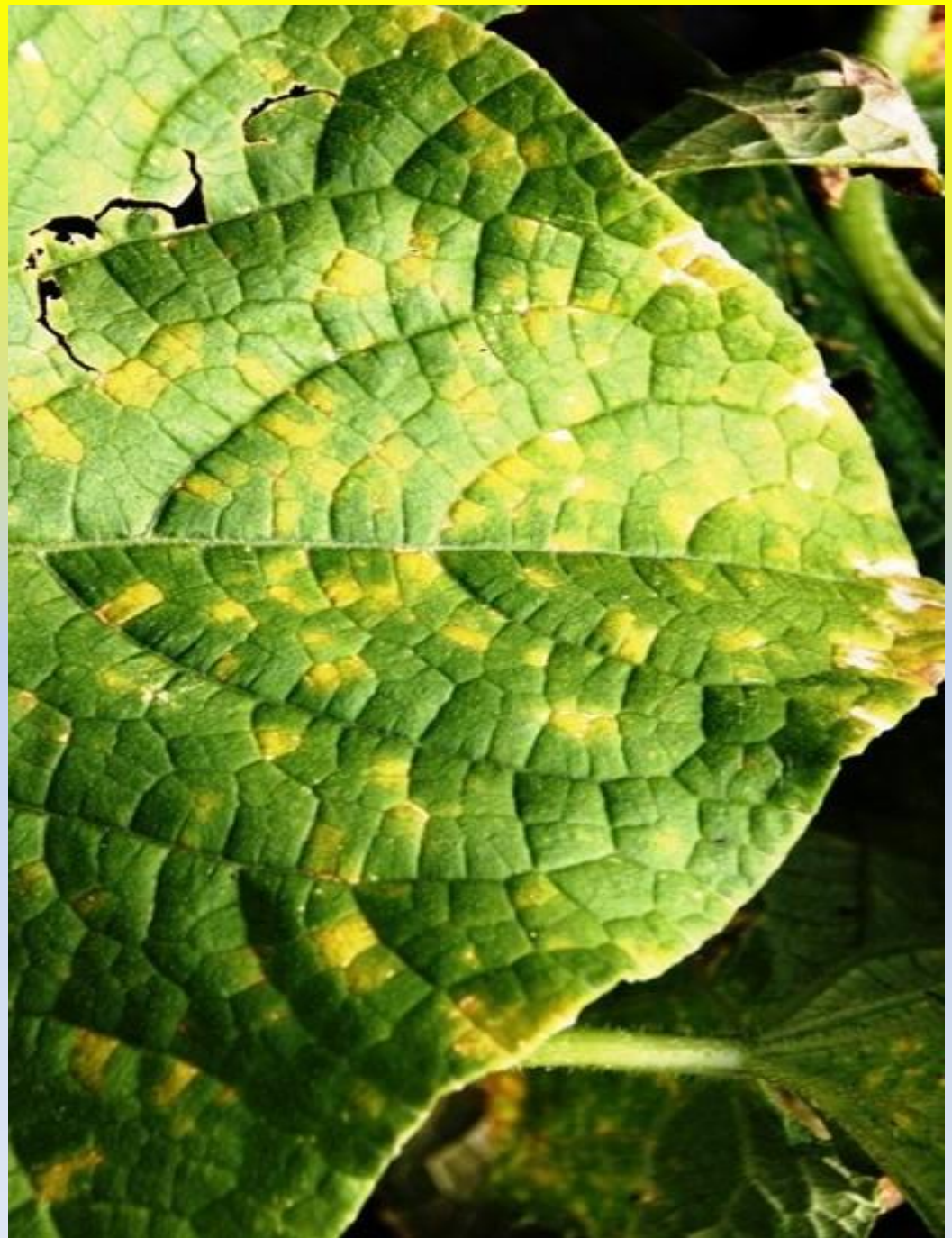
- **Mycelium** is coenocytic and intercellular with small, ovate or finger-like haustoria.
- One to five **sporangiophores** arise through the stomata. **Sporangia** are greyish to olivaceous purple, ovoid to ellipsoidal, thin walled with a distal papilla.

Symptom:

- On cucurbits, other than watermelons, **small, yellowish areas occur** on the upper leaf surface.
- Later a more **brilliant yellow** colour develops. The centre of the lesion **turns brown**.

contd...

- Spots are **angular**.
- A **downy, white - grey - light blue fungus** growth on the underside of individual lesions.
- On watermelons, yellow leaf spots may **be angular** to **non-angular** and turn brown to black.







Mode of spread and survival:


- The pathogen survives on the diseased **plant debris**.
- Pathogen may overwinter as thick walled **oospores**.
- Sporangia** are disseminated by wind, **Cucumber beetles** are reported to carry the sporangia.

Epidemiology:


The optimum temperatures is **16 to 22°C**.


Maximum lesion development **occurs at cycles** of about **25°C** day time, **15°C** night temperature and a **photoperiod** of **6 h darkness**.

Management:


 Use of **bed system** of cultivation, wider spacing and planting sites with good drainage, air movement and exposure to sun light.


 Avoiding **successive plantings in** adjacent fields and use of resistant varieties.

 Many of the **Copper fungicides** and **Bordeaux mixture** have been found to be injurious to cucurbits.

 **Difolatan** 0.2 % or **Mancozeb** 0.2 % or **Chlorothalonil** 0.2 % or **Maneb** spray has been found to be satisfactory.

 Removal and destruction of infected vines.

 Two sprays with **Ridomil MZ-72** (Metalaxyl + **Mancozeb**) at 0.1 % concentration at 30 days interval gives good control of downy mildew of muskmelon.

 Seed treatment with **Apron** at 2 g/kg followed by spraying with **Mancozeb** 0.3 % or **Daconil** 2 kg/ha is effective in controlling the disease.

Cercospora leaf spot/Blotch

Etiology:

Cercospora citrullina (Syn. *C. cucurbitae*) attacks bitter gourd, bottle gourd. -

Conidiophores are long, slender, pale and olivaceous.

Conidia are circular, sparingly septate, hyaline.

C. melonis and ***C. lagenariae*** attacks **bottle gourd**.

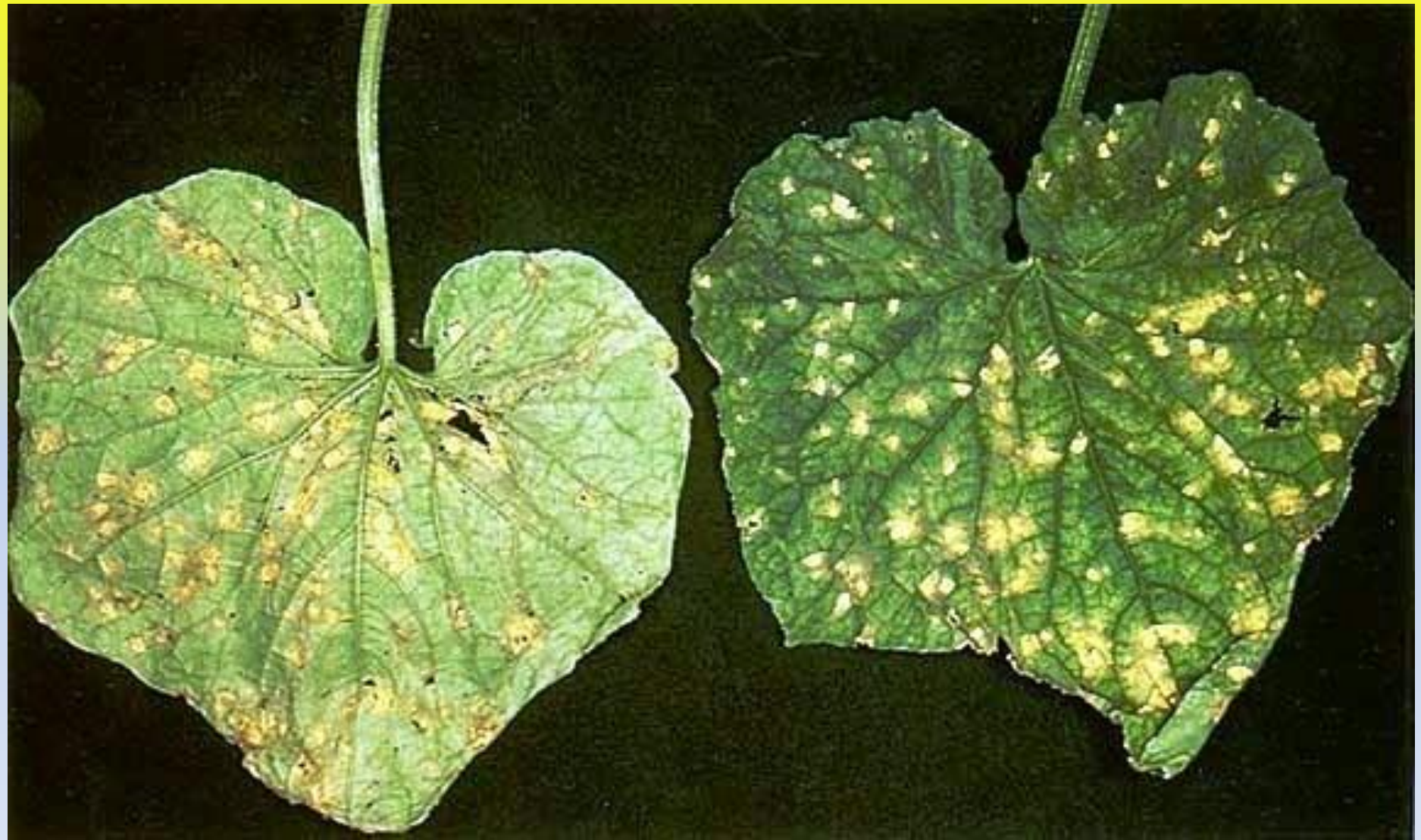
- **Conidiophores** are light brown and arise in convergent tufts, sub-epidermal, mostly straight, non-septate, geniculate. **Conidia** are hyaline, curved, cylindrical.

Symptoms:

- On watermelon foliage, the spots are **small, black** and **circular** with a **grey centre**.
- The badly infected **leaves die and fall**.
- The spots on cucumber, muskmelon and squash foliage are larger and of **grey-golden yellow (ochre)** colour.
- The fruit **is reduced in size** by the defoliation of the vines.



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Mode of spread and survival:


The fungus may overwinter in diseased refuse left in the field.


Conidia formed on **stromata** of plant debris are spread through moist wind.


Epidemiology:

High humidity and temperature of **26 to 30°C** favour the disease development.

Management:

 The disease can be controlled by **burning the** diseased vines.

 Two to three year **crop rotation** of non host crops should be followed to check the disease.

 Spraying with **Zineb 0.2 %** is found to be effective in controlling the disease.

Alternaria leaf spot/Blight

Most of the cucurbits (muskmelon, watermelon *etc.*) are attacked.

Etiology: *Alternaria cucumerina* (*A. brassicae* f.sp. *nigrescens*).

Symptom:

- **Leaf spotting** is the major symptom.
- **Fruit** spots are also noticed.
- First appear on the **oldest leaves**.
- Leaf spots initially are **small and circular, and enlarges** having **definite concentric rings** and margins on the upper surface of the leaves.
- Infected fruits become brown, shrink and later become **black and mummified**.



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Mode of spread and survival:

- The fungus can survive as **mycelium** from diseased plants at least for one season and possibly **two years** in dry conditions.
- Fungus spores **can survive in dry warm conditions** for several months.
- Conidia are **air-borne**






Epidemiology:

High RH is needed for infection.

The optimum temperature is between **20 and 32°C**.

Plants up to 30 days old and plants beyond the flowering stage appear to be **more susceptible**.

Management:

-  **Crop rotation** limits the primary inoculum.
-  Removal of **plant debris** and **deep ploughing**.
-  Use of disease-free seeds and use of resistant varieties.
-  Seed treatment with a fungicide.
-  Spraying with fungicides such as **Chlorothalonil**, **Captafol**, **Mancozeb** and **Maneb**.

Scab

Etiology: *Cladosporium cucumerinum*

Conidia are oblong, dark, mostly aseptate.

Symptom:

- **Scab lesions** appear on all parts of the vine that are above ground.
- First appears as light water soaked or pale green spots on the leaves in between veins.
- Similar elongated, angular spots develop on petioles and stems
- The affected leaves near the tip of the vine may be **stippled with dead and yellowish spots**, stunted and **crinkled**.

contd...

- Fruits are infected at **all stages** of growth but is most susceptible while tender.
- Fruit spots are grey and slightly **sunken**.







Summer squash



Mode of spread and survival:

The fungus survives in **old cucumber refuse** or **soil** in cracks and on **seed**. It is disseminated by **insects**, **clothings** and **tools**.

Epidemiology:

Severe disease development is associated with **cool moist** conditions where **soil drainage is poor**.

Optimum environmental conditions for disease development include **100 % RH** and temperature between **15 and 25°C**.

Management:

 **Crop rotation with corn** once in 4 years.

 Use disease free seeds.

contd...

 Use resistant varieties.

 Spraying with **Maneb, Mancozeb, Chlorothalonil and Captafol** will give effective control.

Fruit rots

Pythium* fruit rot - *Pythium aphanidermatum

- **Mycelium** is intra-cellular, hyaline and coenocytic.
- **Sporangia** are lobulate, bud like out growths.
- **Oospores** are thick walled, aplerotic.
- Skin of the fruit shows **soft, dark green, water soaked** lesions which gradually develop into a watery soft rot.
- **Cottony mycelium** develops on rotting portions in a humid atmosphere.
- In watermelon, **decay** frequently starts at the **blossom end**.
- The inner tissue of the fruit becomes **watery and soft** and the decaying matter emits a **bad odour**.



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***Aspergillus* fruit rot: *Aspergillus flavus* and *A.nidulans*.**

- First **water soaked lesions** are developed on the fruit surface, covered by **greenish or blackish fungal growth** at later stage.
- The lesions are **circular**.
- ***A.flavus*** conidiophores are hyaline.
- ***A.nidulans*** conidiophores are short in length.
- Vesicle is having both primary and secondary **sterigmata**, **Conidia** are globose.

Curvularia* fruit rot: *Curvularia ovoidae

- **Brown to black** irregular lesions.
- Later, infected areas are covered with **dense velvety, black conidial mass of the pathogen.**
- **Mycelium** is dark coloured,
- **Conidia** 3-septate, two inner cells deep brown and outer cells light brown in colour.

Geotrichum* fruit rot: *Geotrichum candidum

- Water soaked lesions on **fruit surface.**
- The fruit skin becomes **soft, sometimes show cracks** on the lesion and **emit bad odour.**
- Occasionally **sap oozes out** of diseased fruits and infected areas are covered with **creamy fungal mass.**

contd...

- At last stage, **black dot-like sporodochia** appears in the centre of lesions.

Myrothecium* fruit rot: *Myrothecium roridum

- Water soaked lesions** on fruit surface which is covered with profuse growth of **dirty white mycelium** with scattered **black pin head sporangia**.
- Conidia** are dark green to black in mass and singly light green, cylindrical, 1-celled.

Rhizopus* fruit rot: *Rhizopus oryzae

- The fungus produces well developed, fast growing **mycelium**.
- Sporangiophores** are mostly in groups having sporangia at the tips.
- Sporangia** are hemispherical.
- **Sporangiospores** are spherical, hyaline.

Soft rot: *Cylindrocarpon tonkinense*

- Early symptom is **slight discolouration** of the fruit skin.
- Ultimately the **entire fruit rots** and white mycelium of the **fungus engulf it**.
- The pulp of the fruit turns **soft and watery**.

contd...

- The ooze from rotten fruits emit an unpleasant smell.
- The fungus enters through broken stalk ends

***Diplodia* fruit rot: *Diplodia natalensis* (*Physalospora rhodina*).**

- Pycnidia are black and large.
- Conidia are colourless, thick walled and one-celled. When mature, they are dark brown, rough walled and two celled.
- Perithecia are single or crowded, globose, black .
- Asci contain eight, one celled, colourless to olivaceous ascospores.

contd...

- **Browning** and **shriveling** of the stem.
- Fruit decay appears around the stem.
- The centre of the spot turns black, **cracks and wrinkles**.
- Spread by **wind, water, insects, tools and workers**.
- Harvest and transport the fruits **with care**.
- Should be harvested with long stems. Then, re-cut the stem with a sharp knife to **avoid bruising** and fully paint with a **fungicide (copper sulphate) paste**.

Phytophthora fruit rot



Fusarium fruit rot - Pumpkin



Rhizoctonia fruit rot



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Bacterial wilt

The bacterium attacks cucumber, pumpkin and many wild cucurbit species.

Etiology: *Erwinia tracheiphila*

It is a motile rod with 4 to 8 **peritrichous** flagella and capsulated. **In Agar**, colonies are small, circular, smooth, glistening white and viscid.

Symptoms:

- Appear **first on leaves**, then affect lateral shoots and the entire plant.
- Sometimes **initial leaf symptoms** are associated with cucumber **beetle chewing injury**.
- Leaf tissue surrounding such an injury becomes **dull green and wilts rapidly**.

➤ Infected leaf may wilt and die.

➤ On squash fruit, small areas of water soaked tissue appear on the fruit surface and minute glistening exudations appear on cut surfaces.

Mode of spread and survival:

- Overwinter in cucumber beetles.
- The bacterium is not seed-borne or soil-borne.
- Bacteria in stems can survive for one month.
- Striped cucumber beetle and the 12-spotted cucumber beetle help in the spread of the bacterium.



Bacterial Wilt



Epidemiology:

Wet weather and heavy rain favour the disease development.

Bacterial wilt is also promoted by unbalanced nutrient situations.


Management:


 Controlling beetles before they feed on plants.

 Use resistant varieties.

 Trap cropping to attract beetles.

 Rogueing diseased plants reduce secondary inoculum.

 Soil treatment at planting with Carbofuran and spraying with insecticide to control beetles.

 Streptomycin 500 ppm and Terramycin 100 ppm can be applied at 4 to 7 days interval to control the disease.

Angular leaf spot

The bacterium attacks cucumber, gherkin, muskmelon, pumpkin, squash and watermelon.

Etiology: *Pseudomonas syringae* pv. *lachrymans*

The bacterium is a rod with 1 to 5 polar flagella. It forms capsule and a green fluorescent pigment in culture.

Symptoms:

- Symptoms appear as water soaked lesions on the leaves and are confined by the veins and become angular.
- They turn grey to tan and form an exudate on the lower surface.
- Dead tissues may drop off leaving shot holes.
- Infected fruits show a brown, circular, superficial, firm rot, the rot may extend into the flesh.













Mode of spread and survival:

Infected seeds may harbour the bacterium. They survive in soil or debris for two years. They spread by irrigation water.

Epidemiology:

- Optimum temperature for disease development is found as 24 to 26°C.
- Promoted by wet conditions with rainfall and sprinkler irrigation.
- Excessive nitrogen levels in the plant increases disease level.

Management:

-  Use of **disease-free seed** and **crop rotations**.
-  Soaking the seeds for 5 to 10 min in **Mercuric chloride 0.1 % solution**, rinsing in water and drying quickly.
-  Spraying the plants with **400 ppm** solution of **Streptomycin sulphate** effectively controls the disease.
-  Use resistant lines.
-  Limiting the use of **overhead irrigation** and **avoiding** use of excessive levels of **nitrogen** controls the disease.
-  Fruit should be harvested **with care** when plants are dry.

Cucumber mosaic

Affects most cucurbits but rarely affecting watermelon.

Etiology: *Cucumber mosaic virus (CMV)*.

The virus particle is isometric.

Symptom:

- New growth is **cupped downward**, and **leaves** are severely **mottled**
- Plants are **stunted**, reduction in **internode length** reduction in **leaf size and petiole**. Such plants seldom produce fruit.
- Fruits are covered with **wart like projections** and distorted














Mode of spread and survival:

The virus is transmitted through **sap and** rarely through seeds. **Aphids and cucumber beetles** (spotted and striped) transmit the virus. The reservoir hosts are **banana, corn, passion fruit, safflower, spinach, sugarbeet, wild cucumber...etc.**

Management:

-  Elimination of the reservoir hosts with double cropping. Use **aluminum mulch** to repels aphid vectors. Plant sanitation is very essential.
-  Eradication of **weed hosts**.
-  Infected plants should be pulled out and **destroyed**.
-  Vectors should be controlled by spraying with suitable **insecticides**.
-  Use **resistant** varieties.

Other virus diseases

1. Watermelon mosaic : *Watermelon mosaic virus*
2. Squash mosaic : *Squash mosaic virus*
3. Ring spot virus : *Tobacco ring spot virus*
4. Bitter gourd mosaic : *Virus*
5. Bottle gourd mosaic : *Cucumber green mottle virus*
6. Ripped gourd mosaic : *Cucumis virus 3*
7. Snake gourd mosaic : *Cucumber mosaic virus*
8. Yellow mosaic : *Yellow mosaic virus*
9. Cucumber green mottle mosaic : *Tobacco mosaic virus*
10. Yellow vein mosaic of pumpkin : *Virus*
11. Vein banding of watermelon : *Vein banding virus*

Watermelon Mosaic

It affects watermelon, muskmelon and cucumber.

Causal agent: *Watermelon mosaic virus* (WMV).

Symptoms:

- Symptoms depend on the host and plant age.
- On **watermelon and muskmelon** plants, symptom includes **stunting, leaf malformation, blistering, yellow or light green mottling and marginal chlorosis**.
- When young plants infected, the **yield** will be reduced. Watermelon fruits on infected vines become **misshapened, dwarfed, mottled or spotted**.
- On **cucumbers**, a fine **uniform green to dark green mosaic symptoms** appear on leaves.
- Fruits produced are **small, curled** and sometimes knobby.


Mode of spread and survival:


Various reservoir hosts serve as a source of the virus for primary disease cycles. *WMV* is transmitted through **aphids** in a non-persistent manner. It is transmitted **by mechanical inoculation** and is **not** transmitted by seeds.

Management:

 **Avoid** reservoir host.

 **Removal and destruction** of infected plants.

 Reduce the spread by aphids by using aphid-repellant mulch and oil sprays.

 **Aluminum foil** repels **aphids** and reduce the spread of aphid-borne viruses.

Squash Mosaic:

This affects watermelon, muskmelon, squash, cucumber and pumpkin.

Causal agent: *Squash mosaic virus*

Symptoms:

- Symptoms of vein clearing and chlorotic spotting of younger leaves.
- Then leaves tend to cup upward and develop a mottling of light and dark green areas.
- A characteristic symptom on squash plants is the presence of filiform leaves with regular marginal projections from the veins.
- The leaves become severely distorted. In advanced stages enations develop on the lower leaf surface.
- Fruits are malformed with raised dome-like swellings.

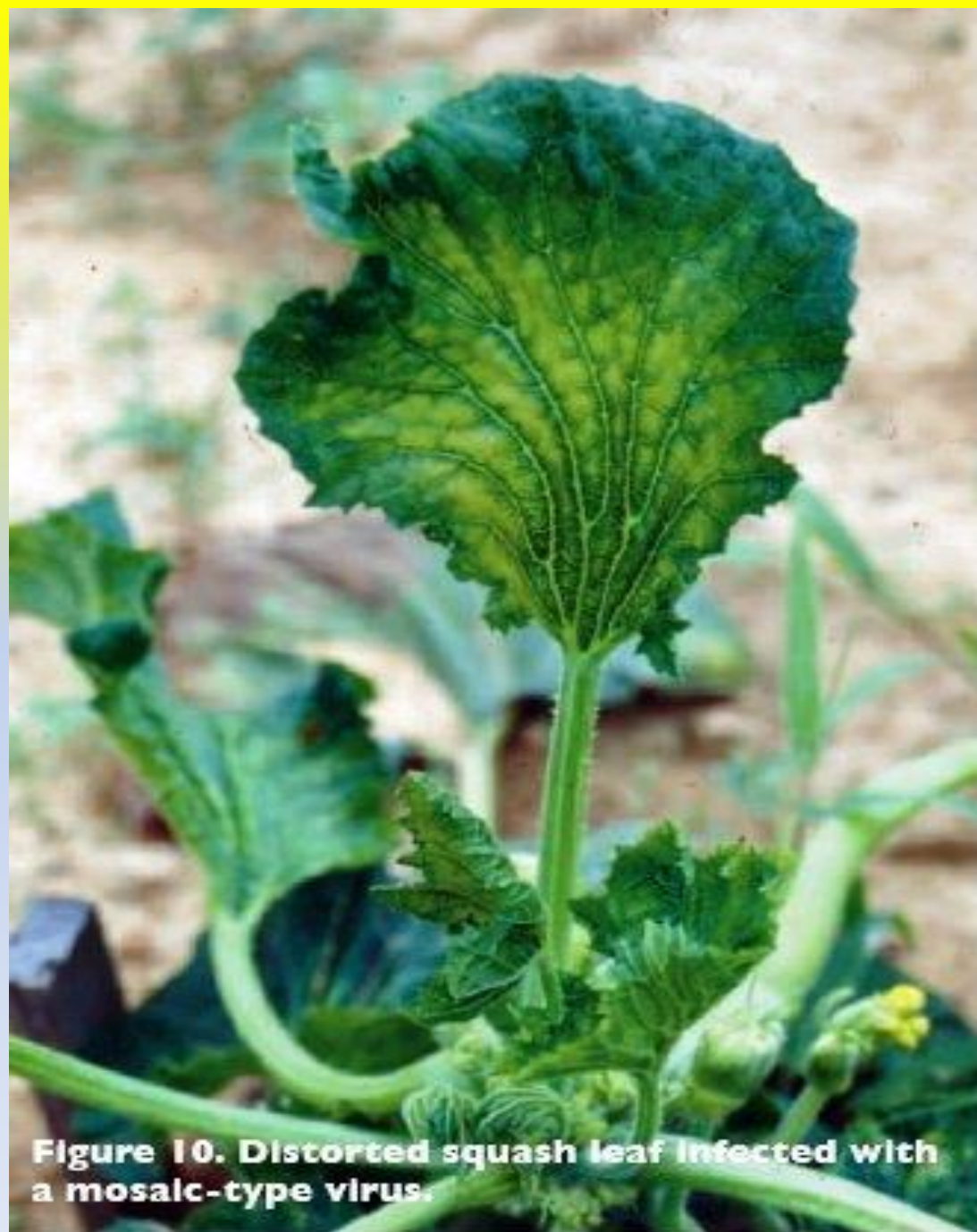


Figure 10. Distorted squash leaf infected with a mosaic-type virus.

Mode of spread and survival:

- Can survive in **infected seed**, in cucurbit weed hosts and **in beetles**.
- It is not transmitted by pollen.

Management:

 Minimize **seed transmission**, eliminate the **reservoir virus hosts** and control beetle **vectors** before they transmit the virus.

 Seed should be produced where SqMV is not prevalent.

Ring Spot

It affects muskmelon, watermelon, squash and cucumber.

Causal agent: *Tobacco ring spot virus* (TRSV).

Symptoms:

- **Muskmelon** – Stunting, yellowing, mosaic mottling and malformation.
 - The spots have definite pin-point centres that appear to be water soaked.
 - Definite rings often develop.
- Fruit set and size are limited..
- **Watermelon** – Severe stunting and chlorosis.
 - Vine tips frequently assume an upright position.

contd...

- Infected leaves **show mottling** and **stems are brittle**. Do not produce marketable fruit.
- Fruit may be **warty** and **may exude viscous liquid** at affected areas.
- **Squash** - Severe **stunting, distorted leaves, vein-clearing and blistering**.
- **Ring spots** and **yellow patches** are associated with veins.
- In **Cucumber** leaves, the first symptom is appearance of **yellow spots** about the size of a pinhead.
- The fruits becomes **mottled**.

Mode of spread and survival:


The TRSV survives in **cucurbit plants, weed host plants, in infected seed** and possibly in the nematode vector, *Xiphinema americanum*.


Other vectors are **mites, tobacco thrips, grass hoppers** and **tobacco flea beetles**.

Mechanical transmission also takes place.

In squash, transmitted by infected pollen during pollination.

Management:

 **Reservoir hosts** around the crop field are to be destroyed by herbicide treatment.

 The disease spread can be reduced by **soil fumigation** to control the **nematode** vectors.

Bitter gourd mosaic

Causal agent: Virus.

- Scattered, small, irregular yellowish patches are seen on the leaves. Leaves show vein clearing.
- Severely infected plants show reduction in their size and elongation and/or suppression of one or two lobes.
- Young leaves are completely distorted, filiform and malformed with considerable reduction in their size.
- Some of the leaves show shoe-string effect. The virus is not sap transmissible.
- Transmitted by Aphids.

- Spraying the crop with **Monocrotophos 0.05 %** or **Phosphamidon 0.05 %** at 10 days interval kills aphid vectors and reduce the disease incidence.
- Spraying with mineral oil (Krishi oil) 5.0 % minimizes the disease spread.



Bottle gourd mosaic:

Causal agent: *Cucumber green mottle mosaic virus* (CGMMV).

Symptoms are light green or dark green **mottling**, occasionally with **pale, yellow chlorotic areas** on the leaves. It is **sap** transmissible. It attacks bitter melon, *Cucurbita moschata* and *Cucumis sativus*.

Ribbed gourd mosaic:

Causal agent: *Cucumis virus 3*. It occurs in India.

Light and dark green **mosaic mottling**, downward **curling** of leaf margins and general **stunting** in plant growth. Affected plants bear only few flowers and fruits; The virus is found to be **sap transmissible**.

BOTTLE GOURD





Snakegourd mosaic:

Causal agent: *Cucumber mosaic virus*.

The disease is characterised by a mosaic pattern of irregular dark green and yellow chlorotic patches on the lamina.

Affected plants are stunted, produce few flowers and show leaf crinkling. Disease is transmitted by mechanical inoculation and by insect vectors, *Aphis gossypii* and *Myzus persicae*. It infects *Cucurbita pepo* also.

Yellow mosaic:

Infected plants exhibit a striking yellow vein mosaic in leaves. *Bemisia tabaci* transmits the disease. It infects pumpkin and ribbed gourd.



Cucumber green mottle mosaic:

The virus infects bottle gourd, cucumber, pumpkin, ridge gourd, snake gourd, squash and watermelon.

A strain of *Tobacco mosaic virus* (TMV).

- Slight **clearing of veins and crumpling of young** leaves
Dark or light green mottle, together with blistering
- Distortion of the leaves and stunting of the plant.
- Yellow flecks on leaves showing green mottle is a **prominent symptom** on fully developed leaves.
- The fruit is slightly mottled.
- Easily **sap transmissible** and is also transmitted through seeds. Sanitation is necessary and disease free seeds are used.

Yellow vein mosaic of pumpkin:

The virus infects Cucumber and Snakegourd.

The characteristic symptoms are vein **yellowing, vein clearing and mosaic.**

Mosaic symptoms are produced on the leaves.

Fruits are small **and deformed.**

The disease is transmitted by **sap and by whitefly.**

Straw mulching delays the onset of infection.

The disease spread can be reduced by spraying with

Monocrotophos 0.05 %.

Mycoplasma diseases

1. Phyllody of chow chow : MLO

2. Cucurbit phyllody : MLO

3. Bitter gourd witches' broom : MLO

Phyllody of chow chow:

- Mycoplasma-like organism.
- The disease is characterised by **shortening of internodes and reduction in floral pedicels.**
- The flowers **develop abnormality.**
- Floral parts are transformed into **green leaf-like** structures.
- The ovary turns into **long petiole-like** outgrowth. **Stamens and stigma** become thick and leaf-like.
- Infected plants do not bear fruits.
- The disease is only transmitted by **grafting.**

Cucurbit phyllody:

- Mycoplasma-like organism.
- Phyllody is observed in bitter gourd, bottle gourd, cucumber, ridge gourd and snake gourd
- Symptoms are shortening of internodes and phyllody of normal flowers.
- Transformed into green leaf-like structures.
- Infected plants become dull pale and stunted.
- The disease is transmissible by grafting and leaf hopper.
- Infected plants should be removed from the field as and when noticed.
- Spraying with systemic insecticides at 10 days interval to controls the insect vector.

Bittergourd witches' broom:

- Mycoplasma-like organism.
- Malformation and proliferation of axillary buds.
- Many abnormal little leaves.
- Internode bud sprouts and give many bud-like chlorotic leaves arising from internodes.
- Flowers are green and phylloid.
- Fruits are small, cylindrical and deformed and have no seeds.
- Leaf hopper has been suspected as insect vector.
- The disease is easily transmissible by grafting.

- Application of **Carbofuran** @ 1.5 kg/ha at the time of sowing followed by 5 or 6 foliar sprays of **Phosphamidon** or **Monochrotophos** or **Methyl demeton** at 10 days interval controls the vector.
- Spraying of **Oxytetracycline hydrochloride** solution at 500 ppm at weekly interval to suppress the symptoms.
