

Brinjal and Bhendi





Brinjal / Egg Plant

Important diseases of Brinjal

1. *Verticillium* wilt : *Verticillium dahliae*
2. *Phomopsis* blight and fruit rot : *Phomopsis vexans*
(*Diaporthe vexans*)
3. Bacterial wilt : *Burkholderia solanacearum*
4. Little leaf : Mycoplasma - like organisms
5. Minor diseases : Many

Minor diseases

- a) Damping off : *Pythium indicum*, *P.aphanidermatum*,
Phytophthora parasitica, *Rhizoctonia solani* , *Sclerotium rolfsii* & *Pellicularia filamentosa*
- b) *Fusarium* wilt : *Fusarium solani*
- c) Black dot root rot : *Colletotrichum atramentarium*
- d) Blight : *Phytophthora meadii*
- e) *Sclerotinia* blight : *Sclerotinia sclerotiorum*
- f) Leaf spots : *Cercospora solani - melongenae*,
& *C. melongenae*
- g) Rust : *Puccinia penniseti*
- h) Powdery mildew : *Erysiphe polyphaga*
- i) Anthracnose : *Colletotrichum melongenae*

contd...

Minor diseases

- j) Leaf spot and fruit rot : *Alternaria solani* &
A.melongenae
- k) *Pythium* fruit rot : *Pythium aphanidermatum*
- l) *Phytophthora* fruit rot : *Phytophthora nicotianae* var.
nicotianae
- m) Mosaic diseases : *Potato virus Y* & *Tobacco*
mosaic virus
- n) Ring spot : *Tobacco ring spot virus*
- o) Enation leaf curl : *Brinjal enation leaf curl virus*

1. *Verticillium wilt* (Brinjal)

Etiology : *Verticillium dahliae*

➤ Mycelium is white to greyish, brown to black, septate and swollen between septa.

➤ Conidiophores are erect, hyaline, verticillately branched. Conidia arise singly, elliptical to irregularly

➤ sub-cylindrical and hyaline, unicellular or bi-cellular.

Chlamydospores are not formed.

Symptoms :

- **Drooping** of old leaves and irregularly scattered pale yellow patches in the **inter-veinal areas** on the leaf lamina.
- Appearance of **marginal yellowing** and **drying** which proceeded from one margin to the other.
- In advanced stage, **marginal flagging** and **curling of leaf lamina**.
- Affected areas become **necrotic, coalesce** and cause complete drying.
- The characteristic symptom is **conspicuous browning of the vascular tissue of the root and stem**. The vascular browning sometimes extends up to the petiole.





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Mode of spread and survival:

- Primarily a **soil infesting** and **root invading** pathogen, which produces **numerous spores**.
- Survives and transported over long distances through seeds or other plant parts.
- **Secondary infection** of aerial parts of brinjal is by **air-borne conidia**.

Epidemiology:

The optimum temperature is from **22 to 24°C**

Management:

- 🍆 Complete elimination or control is impossible.
- 🍆 Brinjal cultivation and other susceptible crops should be avoided to reduce the inoculum.
- 🍆 Avoid the use of seeds obtained from localities where the disease is prevalent.
- 🍆 Seed treatment to eliminate the spores sticking on the surface of the seeds.
- 🍆 Isolation of infected field, raising the crops like paddy, pearl millet, ragi and sorghum instead of brinjal and incorporation of increased doses of organic manures and potash control the disease.

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🍆 Application of higher doses of nitrogenous fertilizers should be avoided.

🍆 Infected materials should not be left in the field and should be destroyed by burning at the end of every season.

🍆 Deep ploughing and exposing the soil during summer and drenching the soil around the plants with wet Ceresan 0.1 % reduces the disease incidence.

🍆 Drenching or spraying the plants with Benomyl 0.1 % is useful.

2. *Phomopsis* blight and fruit rot (Brinjal)

Etiology : *Phomopsis vexans* (*Diaporthe vexans*)

Pycnidia are with or without beak, erumpent, brown to black and globose or irregular.

Conidiophores are hyaline, simple or branched and sometimes septate.

Pycnidiospores are hyaline, one celled and sub-cylindrical.

Perithecia are usually in clusters.

Asci are clavate, sessile, 8-spored.

Ascospores are hyaline, narrowly ellipsoid.

Symptoms:

- **Blight** on young seedlings.
- The stem **is girdled** slightly above the soil line, the plant **topples over** and dies.
- The stem **lesion is dark brown**, becoming **grey** in the centre as **pycnidia develop**.
- Brown, round or oval spots develop on the leaf, **becoming irregular in shape**.
- The **centre** becomes grey and **contains pycnidia** while the margin has a narrow dark brown zone.
- The decay being **soft and watery** and later black and mummified as **pycnidia develop** abundantly over the fruit surface.





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Mode of spread and survival:

The fungus survives in the **infected plant debris** in the soil.

It is **seed-borne**.

The spores are spread by **rain splashes**.

The fungus spreads through **implements and insects**.

Epidemiology:

The optimum temperature for fungal growth is **29°C**.

The fungus requires wet weather and high temperature.

Storage rot of fruit is maximum at **25°C**.

Management:

🍆 Dipping of seeds in **hot water at 50°C**.

🍆 Spraying with **Difolatan 0.2 %** or **Captan 0.2 %** in the nursery and field at 7 to 10 days interval controls the disease.

🍆 Deep **summer ploughing**, three year **crop rotation** and collection and **destruction** of diseased plant debris are some of the other control methods.

🍆 Spraying the crop in the field with **Zineb 0.2 %** or **Bordeaux mixture 0.8 %** is effective in controlling *Phomopsis* blight.

3.Bacterial wilt (Brinjal)

Etiology: *Burkholderia solanacearum* (*Pseudomonas solanacearum*)

It is a short rod and gram -negative. The bacterium is motile by a polar flagellum.

Symptoms:

- **Sudden wilting** of the affected plants.
- **Drooping** of young top leaves and shoots of the plants. The plants die within 3 to 5 days.
- **Water soaked areas** in the form of **black streaks** on the stem.
- These areas **rot completely** and **bacteria ooze** out from those portions in the form of **minute droplets**.

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- Shows **brown discolouration in the vascular** region and bacteria ooze out in the form of **milky white stream**
- Severe during monsoon when the fields are waterlogged.





Mode of spread and survival:

The pathogen is found to be alive in the **infected plant debris** for about 10 months. Presence of root knot nematode, *Meloidogyne javanica* increases the wilt incidence.

Management:

 Use bacterial wilt resistant varieties like **Arka Keshav, Arka Neelkant, Pusa Purple Cluster** and **Pusa Purple Round... etc.**

 Avoid highly susceptible varieties like Pusa Purple Long.

 **Crop rotation** of egg plant - French bean - finger millet reduces the disease

4. Little leaf (Brinjal)

Etiology: Mycoplasma like organism

Symptoms:

- Reduction in size of leaves.
- New leaves produced become smaller and smaller.
- The petiole size and lamina are also reduced and become sessile.
- The leaves become thin, soft, glabrous, pale green and the thorns disappear.

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- The growth of **auxiliary buds** is stimulated and is accompanied by the **shortening of internodes** of the branches. The plant presents **bushy appearance**.
- There will be **no floral parts** present and they are modified into green structures.
- As a rule, the affected **plants are sterile** and do not bear fruit.
- If any fruit is formed, it becomes **hard and tough** and fails to mature.
- Young fruit becomes **necrotic**, get **mummified** and **cling** on to the plant.





Mode of spread and survival:


The disease is transmitted by **leaf hoppers** (*Hishimonas phycitis*) and grafting.

Virus spreads through weed host.

Management:

 Abolition of all **solanaceous crops, weed hosts** and infected plants will minimize the sources of infection.

 Spraying **Malathion** 0.05 % to kill the leaf hoppers will check the spread.

 Use **Tetracycline** (10 ppm to 50 ppm) or **Chloramphenicol** (50 to 100 ppm) antibiotics to reduce the incidence.

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 The antibiotics give temporary control of the disease.

 Varieties like **Arka Sheel, Aushy, Banaras Giant, Manjari**

Gota, and Pusa Purple Cluster are moderately resistant

while **Black Beauty, Brinjal Round and Surati** are tolerant.

Pusa Purple Long and Selection-T are highly susceptible.

Minor Disease

a. Damping off

Causal agent: *Pythium aphanidermatum*, *P. indicum*, *Phytophthora parasitica*, *Rhizoctonia solani*, *Sclerotium rolfsii* and *Pellicularia filamentosa*.

- It is very **severe** in the nursery.
- Sudden collapse of the seedlings occur in the seed bed. The seedlings are attacked **at the collar region** and the attacked seedlings are topple over.
- Spreads through **fungi** present in the soil. The fungus is eradicated by **hot water seed treatment at 52°C** for 10 min.
- **Rotation of seed bed** and **application of fungicide** to soil controls the disease.



Damping off



b. Fusarium wilt:

Causal agent: *Fusarium solani* .

- Mycelium of the fungus is greyish to white.
- Fungus produces **microconidia**, **macroconidia** and **chlamydospore**.
- The leaves become **flaccid** and hang down.
- In course of a week the **plant dries up**.
- The collar region and base of the stem are found to be **shrunk**. **Whitish growth of the fungus** is visible on the surface of the stem in the soil level.
- The disease can be controlled by drenching the soil with **Bordeaux mixture 1.0 %**.

c. Black dot root rot

Causal agent: *Colletotrichum atramentarium*

- The fungus produces **acervuli**.
- **Conidiophores** cylindrical to clavate, 2 to 3 septate.
- **Conidia** are single celled and hyaline.
- Diseased plants are **stunted**.
- **Root system** is poorly developed.
- Infected roots show **brownish to blackish** lesions.

d. Blight

Causal agent: *Phytophthora meadii*

- Fungus produces **sporangia**.
- **Brownish, black circular** to oval water soaked lesions appear on the fruits.
- Rotting tissues show plenty of **mycelia**.

e. Sclerotinia blight

Causal agent: *Sclerotinia sclerotiorum*

- Mycelium is **hyaline** and much branched.
- Hyphae are **septate**. The fungus is **soil-borne**.
- **Dry, dis-coloured spot** at any part of the stem or branch. It girdles the stem and progresses up and down.
- Affected **plant wilts**.

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- When affected stem is split open, the **pith will** show large number of **brown sclerotia**.
- When the fruits are attacked the **inner flesh** rot.
- The infected crop debris should be collected and **burnt to reduce** the disease.
- Deep **summer ploughing** by which the incidence is reduced.

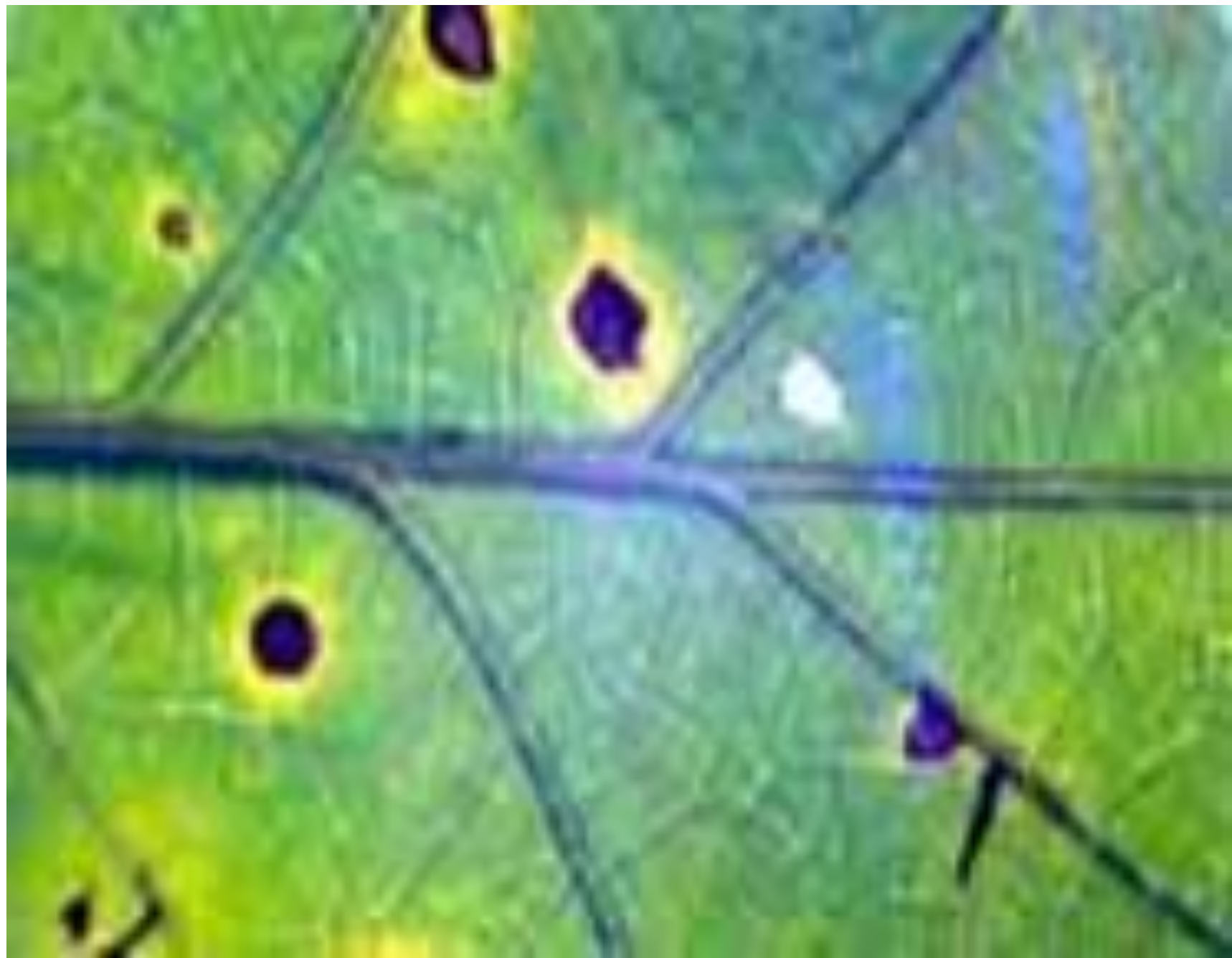
SCLEROTINIA BLIGHT



f. *Cercospora* leaf spots

Causal agent: *Cercospora solani-melongenae*, *Cercospora melongenae*

- Dark reddish brown spots occasionally bordered by an indistinct dark zone
- Chlorotic spots enlarges and become grey to brown.
- Disease is spread by air-borne conidia.
- Heavily diseased leaves should be collected and destroyed.
- Spraying with Mancozeb 0.2 % is effective in controlling the disease.



g. Rust

Causal agent: *Puccinia penniseti*

- Infected portion of the leaf is light green, thickened and usually concave on the upper surface with a corresponding convex bulge on the lower surface.
- Orange yellow minute dots are seen on the upper surface of the leaves.
- The petioles are also affected.
- Pathogen produces pycniospores, aeciospores, uredospores and teliospores.



h. Powdery mildew

Causal agent: *Erysiphe polyphaga*

- Small **circular to irregular white powdery** areas on both the leaf surfaces.
- Stem and the petioles are covered with **white mycelial** growth. Spreads from lower to upper leaves. Results in chlorosis.
- Mycelium is **greyish white, superficial, septate**, profusely branched.
- **Conidiophore**, are erect unbranched, septate. The conidia are single celled, hyaline, oval to cylindrical or elliptical.
- Spraying with benomyl 0.1 % or **Carbendazim** 0.1 % or **Wettable sulphur** 0.3 % is effective.
- Use resistant varieties.



i. Anthracnose/Fruit rot

Causal agent: *Colletotrichum melongenae*.

- Lesions are **sunken** and may coalesce.
- Tan coloured **ooze of fungal spores** appears on lesion.
- Fruit drops and dries and becomes black.
- Elimination of reservoir hosts such as *Solanum torvum* (Turkey Berry), **destruction** of plant debris and **crop rotation** will reduce the inoculum.



j. Leaf spot and fruit rot

Causal agent: *Alternaria solani*

- **Mycelium** is septate, branched, light brown to dark brown.
- **Conidia** are single celled, dark and beaked.
- Small, circular, brown, necrotic spots on the leaves which coalesce and results **in withering and shedding.**
- On fruits, small, **concentric dark brown and sunken spots** which coalesce and cover the fruit.
- The disease is spread by **wind-borne conidia.**
- Older plants are more **susceptible.**



k. *Pythium* fruit rot

Causal agent: *Pythium aphanidermatum*

- The **decay** begins at the blossom end.
- The **purple colour** of the skin bleaches and turns to **tan colour. Wrinkling follows**. The fleshy tissue rapidly becomes watery and light brown.
- Mycelium is coenocytic and white.
- **Diseased fruits** at harvest should be **discarded**.



I. *Phytophthora* fruit rot

Causal agent: *Phytophthora nicotianae* var. *nicotianae*.

- Small, water soaked lesions on fruits which enlarge in size considerably.
 - The skin shows discolouration, turns greyish brown and develop white, cottony mycelium in humid weather.
- Rotten parts become depressed and wrinkles, turn brown, soft and watery.
- Fruits develop rotting and most of them drop. The disease spreads rapidly during rainy season.



m. Mosaic diseases

i) *Potato Virus Y*(PVY).

- Mosaic **mottling and stunting** are noticed.
- The infected leaves are **deformed, become small and leathery**. Yield is much reduced.
- The virus is **sap transmitted** and also by aphids (***Aphis gossipii* & *Myzus persicae***) in a non-persistent manner.

ii) *Tobacco mosaic virus* (TMV):

- Prominent **mosaic mottling** of leaves.
- Develop **blisters in advanced** cases.
- Leaves become small, mis shapen and plants remain stunted.
- Transmitted by **sap**, contaminated **implements, clothes, soil debris** and hands of workers

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- No insect vector has been reported.
- The virus has very wide host range.
- The virus can perpetuate on many cultivated plants like cucurbits, legumes, pepper, tobacco, tomato and many weed hosts.
- The virus survives in the plant debris.
- Destroy all perennial weeds and avoid planting of other host crop.
- Prohibit smoking or chewing of tobacco by those who are handling brinjal seedling.
- Wash the hands well with soap and water before working in the seed beds.



n. Ring spot

Causal agent: *Tobacco ring spot virus.*

- Conspicuous **chlorotic concentric rings** on the leaves and fruits.
- Mosaic **mottling symptoms**, small and deformed leaves and stunting also noticed.
- Number of branches are **reduced**.
- Few fruits of **small size** with numerous **ring spots**.
Infected fruits are disfigured.
- The virus is **sap transmissible**. The insect vector **is not known**.

o. Enation leaf curl

Causal agent: Virus.

- **Conspicuous**, bold enations on the lower side.
- Leaves become thick and leathery.
- Upward curling of leaves is **an important symptom**.
Leaves becomes **very rough** and gives an ugly appearance.
The leaves size is reduced.
- The infected plants show **stunted growth**.
- **Enations are systemic in nature, i.e., they are found on leaves, pedicel, corolla and calyx.**
- The disease is transmitted by **grafting but not by sap**. It is also transmitted **through seeds** of infected plants.



Bhendi / Okra



Important diseases of Bhendi

1. **Wilt** : *Fusarium oxysporum* f.sp. *vasinfectum*
2. **Powdery mildew** : *Erysiphe cichoracearum*
3. **Leaf spot** : *Cercospora abelmoschi*, *C.hibiscina*,
C.malayensi
4. **Yellow vein mosaic** : *Bhendi yellow vein mosaic virus*
5. **Minor diseases** : Many

Minor diseases

- a) *Phoma* leaf spot : *Phoma putaminum*
- b) *Curvularia* leaf spot : *Cochliobolus lunatus*
(*Curvularia lunata*)
- a) Leaf blight : *Macrophomina phaseolina*
- b) *Phoma* canker : *Phoma exigua*
- c) Bacterial leaf spot : *Xanthomonas campestris* pv.
esculenti
- a) Enation leaf curl : Virus

1. Wilt (Bhendi)

Etiology: *Fusarium oxysporum* f.sp. *vasinfectum*

Macroconidia are 3 to 5 septate formed **on sporodochia**.

In mass, **conidia** appear buff or salmon orange in colour.

Macroconidia are fusiform and curved inward at both ends.

Symptoms:

➤ The symptoms appear as **yellowing and stunting** of plants followed by **wilting and rolling** of leaves.

➤ Finally the whole **plant dies**.

➤ When the affected plant is pulled out and cut longitudinally there will be **dark brown vascular discolouration**.

➤ In severe cases of attack the stem becomes black.



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Mode of spread and survival: The fungus is **soil-borne**.

Epidemiology:

Crops sown in **May to June** suffer more than the crop sown during February to March.

Young plants are more susceptible compared to mature plants.

The optimum temperature **is 25°C**.

Management:

- 🌿 Treat the seeds with **Mancozeb** @ 3g/kg seed.
- 🌿 Drench the field with **Copper oxychloride** @ 0.25%.
- 🌿 Use resistant varieties.
- 🌿 **Rotation of crops** and removal of affected plants, help in minimizing the disease incidence.

2. Powdery mildew

Etiology: *Erysiphe cichoracearum*

Conidia are single celled, hyaline, barrel-shaped.

Cleistothecia are globose, dark with **myceloid** appendages. The **asci** are pedicellate, ovate or ellipsoid. Usually 2 **ascospores per ascus**.

The **ascospores** are single celled, hyaline, oval to sub cylindrical.

Symptoms:

- **White or greyish** patches of powdery fungal growth on the upper surface of leaves.
- Diffused without any marked boundary covering the entire leaf.
- Leaves **dry up and fall off** prematurely.
- Causes more effect on **plant growth and yield**.



Epidemiology:

Dry weather conditions favour powdery mildew.

The disease is observed commonly during Sep to Dec.

Favourable temperature for disease development is 15 to 30°C.

Management:

☞ Application of **Wettable sulphur** 0.2 % or **Sulphur dust** at 25 kg/ha thrice at 20 days interval or four times at 15 days interval is effective.

☞ First spray should be given immediately after the appearance of the disease.

☞ Spraying with **Carbendazim** 0.1 % or **Benomyl** 0.1 % is also effective.

3. Leaf spot

Etiology: *Cercospora abelmoschi*, *C. hibiscina*,
C. malayensis

Conidiophores are pale to medium olivaceous brown, multiseptate, sometimes branched.

Conidia are olivaceous brown, straight to curved and 1 to 8 septate.

Symptoms:


- *Cercospora malayensis* causes brown, irregular spots and *C. abelmoschi* causes sooty black, angular spots.
- All the three pathogens cause severe defoliation and are common during humid seasons.



Mode of spread and survival: The fungus survives in the diseased crop material.

Epidemiology: The disease development is favoured at 25 to 29°C

Management:

 Copper oxychloride 0.3 % or Bordeaux mixture 1.0 % or Zineb 0.2 % or Captan or Difolatan 0.2 % or Carbendazim 0.1 % spray is effective.

4. Yellow vein mosaic

Etiology: *Bhendi yellow vein mosaic virus (BYVMV)*

Symptoms:

- **Clearing of small veins** *i.e.*, green colour along the vein is bleached and turns yellow. Extends further into the inter-veinal portions. Green **inter-veinal tissue** will be very much reduced.
- Prominent **bands of yellow tissue along the veins**. Entire leaf becomes chlorotic.
- Veins are considerably thickened.
- **Stunted** and form a few fruits which may be smaller and malformed.
- The fruits become **fibrous and tough**. Yield of fruits are reduced.



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Mode of spread and survival:

The virus is spread by **white fly** in a persistent manner.

Not by **seeds, sap or pollen**.

Even a single **whitefly** can transmit the virus.

The virus infects some weeds also.

Epidemiology:

Disease incidence is high when temperature remains high and humidity is less, which favours **whitefly multiplication**.

Continuous cropping provides the inoculum throughout the year.

Management:

- Removal and destruction of diseased plants.
- Eradication of weed host.
- Crop rotation may be followed.
- Use highly resistant varieties like Arka Abhay, Arka Anamika... etc.
- Soil application of Carbofuran @ 1.5 kg a.i./ ha at the time of sowing, followed by 4 or 5 foliar sprays of Dimethoate 0.05 % or Methyl demeton 0.02 % or Monocrotophos 0,05 % at 10 days interval.
- Border cropping with sorghum or maize or pear millet may be followed.