

Module 20: Diseases of Tea and its management

Objectives

The main objectives of this chapter are to acquaint the students about:

1. the important diseases of tea and
2. the favourable condition, symptoms and management of important diseases of tea.

Summary

Tea is one of the important plantation crops providing huge foreign exchange to Indian economy. As tea is made from the leaf, so leaf diseases play an important role in reducing quality of tea. Among the important diseases of tea, blister blight is considered the most important, followed by root rot diseases. Leaf diseases such as black blight or thread blight, pink disease and algae on leaves causing the red rust can be a severe problem in humid climates. Prevention is very important since root disease is difficult to control once plants are infected. Grafting on resistant root stock, procuring the healthy plants, choosing locations having a good drainage for planting, application of fungicides, *Trichoderma spp* can control root disease.

India is the largest producer and consumer of tea (*Camellia sinensis*) in the world. It is grown mainly in three major regions in India: the Nilgiris region in Southern India and Assam and Darjeeling in North-East. The largest producers of tea are Assam (50.75%), West Bengal (22.1%), Tamil Nadu (15.9%) and Kerala (8.3%). Other areas where tea is grown to a small extent are Karnataka, Tripura, Himachal Pradesh, Uttarakhand, Arunachal Pradesh, Manipur, Sikkim, Nagaland, Mizoram, Bihar and Orissa.

Since the leaves are the harvest product in tea, leaf diseases play an important role. The most important disease being the blister blight found in Asia, followed by the worldwide present root diseases. Regarding leaf diseases, the black blight or thread blight (*Corticium invisum*), the pink disease (*Corticium salmonicolor*) and algae on leaves causing the red rust (*Cephaleurus parasiticus*) can be a severe problem in humid climates.

IMPORTANT LEAF DISEASES

1. Blister blight : *Exobasidium vexans*
2. Dieback and Canker, *Glomerella cingulata*
3. Black blight, thread blight : *Corticium koleroga*, *C. invisum* syn. *Pellicularia koleroga*
4. Grey blight: *Pestalotiopsis theae*
5. Red rust: *Cephaleurus parasiticus*
6. Pink disease: *Corticium salmonicolor*
7. Wood rot: *Hypoxylon serpens*
8. Stem canker/ twig dieback: *Macrophoma theicola*
9. Thorny stem blight: *Tunstallia aculeata* Petch 10
10. Flower blight: *Ciborinia camelliae*
11. Collar Canker: *Phomopsis theae*
12. Horse hair blight: *Marasmius crinisequi*

Blister Blight

Causal organisms: *Exobasidium vexans*, *E. camelliae*

Symptoms

Blister blight is the most serious disease affecting shoots of tea and is capable of causing

enormous crop loss. The disease is endemic to most tea-growing areas of Asia but is not known to occur in Africa or the Americas. For Blister blight, translucent spots appear on tender leaves, tender stem, leaf galls, new shoots and leaves become enlarged, thickened and fleshy, and appear abnormal. Hardening of the galls. First, pale yellow translucent spots, then circular blisters on leaf underside. Then white velvety and later circular brown spot.

Epidemiology

Cloudy, wet weather favours infection. Shan or Indian varieties of tea are somewhat resistant to this disease. The disease cycle repeats continuously during favourable (wet) conditions and the spores are readily dispersed by wind. Spores that land on a leaf with adequate moisture will germinate and infect it, producing visible symptoms within 10 days. The fungus can directly penetrate the leaf tissue. The basidiospores have a low survival rate under conditions of drought or bright sunlight. The life cycle of the fungus is 3–4 weeks.

Management

1. Rake up and remove fallen leaves.
2. Removing and destroying young galls.
3. Use of chemical agent such as Mancozeb before infection occurs.
4. Need based application of 1% Bordeaux mixture.
5. Application of fungicides such as Hexaconazole, Bitertanol, Propiconazole and Tebuconazole.

Dieback and Canker

Causal organism: *Glomerella cingulata*

Symptoms

It is one of the most serious of all tea diseases. Leaves on affected branches suddenly turn yellow and wilt. Branch tips usually die. Gray blotches appear on the bark and stem and then sunken areas (cankers) develop, eventually girdling the stem. Parts of the plant above the stem canker lose vigour, wilt and die. Damaged plants show more symptoms during hot, dry weather.

Management

1. To keep the plant as healthy as possible.
2. Plant in a well-drained acidic soil, avoid wounding and fertilise properly.
3. By pruning several inches below the cankered areas remove the diseased twigs.
4. Disinfect pruning tools between all cuts, using a solution of one part household bleach to nine parts water.
5. Fungicides, such as Thiophanate-methyl and Copper salts of fatty acids can be applied during wet periods and normal leaf drop periods to protect fresh leaf scars from infection.

Black blight or thread blight

Causal organisms: *Corticium koleroga*, *C. invisum* syn. *Pellicularia koleroga*

(Basidiomycotina, Hymenomycetes, Aphylophorales, Corticiaceae)

Symptoms: Leaves and twigs turn brown. Dead leaves are hanging on thin threads from the branches. Under humid conditions in the tropics.

Grey blight

Causal organisms: *Pestalotia theae*/*Pestalotiopsis theae*

Symptoms

Mature leaves, young shoots and bare stalks are affected. Grey blight adversely affects the health of the bushes, which in turn affects yield and dieback of young shoots directly leading

to substantial crop loss. Round, irregular, grey and necrotic leaf lesions. In the centre of older spots black fruiting bodies appear (acervuli). Mostly attacks weak or damaged tea bushes.

Epidemiology

The tiny, black spots on the lesions contain the fungal spores. Rain splash transports the spores from one plant or site of infection to another. If the spores land on a leaf, they germinate to start a new leaf spot or a latent infection.

Management

1. Spraying of Carbendazim, Mancozeb, or Thiophanate methyl.
2. Avoid plant stress. Grow tea bushes with adequate spacing to permit air to circulate and reduce humidity and the duration of leaf wetness.

Red rust

Causal organisms: *Cephaleurus parasiticus*, *C. virescens*

(Algae, Heterokontophyta [=Chrysophyta])

Symptoms

Most algal spots develop on the upper leaf surface. Red film covering leaves and branches. Leaves develop lesions that are roughly circular, raised and purple to reddish-brown. Most algal spots develop on the upper leaf surface. Older infections become greenish-gray and look like lichen. *Cephaleuros* usually does not harm the plant. The algae produces microscopic, rust-coloured, spore-like bodies on the surface of the leaf spots, giving them a reddish tinge.

Epidemiology

Algal leaf spot has a wide host range among tropical trees. The “spores” are dispersed by wind or rain. The alga may spread from leaves to branches and fruit. Poor soil drainage, imbalanced nutrition and exposure to relatively high temperature and humidity predispose tea plants to infection by algal leaf spot, so it is important to strengthen the plant through proper cultivation and fertilisation.

Management

1. Avoid plant stress. Avoid poorly drained sites.
2. Promote good air circulation in the plant canopy to reduce humidity and duration of leaf wetness.

Pink disease

Causal organism: *Corticium salmonicolor*

(Basidiomycotina, Hymenomycetes, Aphyllophorales, Corticiaceae)

Symptoms

Pink crust on twig and branches. The portion above the branches dies off and cause dieback. The disease is prevalent under humid conditions in the tropics.

Wood rot

Causal organism: *Hypoxylon serpens*

(Ascomycotina, Pyrenomycetes)

Symptoms

Stem canker and wood with blackish patches and lines.

Twig dieback/ stem canker

Causal organism: *Macrophoma theicola*

This disease is capable of reducing yields and can kill entire plants. Rainy weather favours its spread and dry conditions promote its development.

Symptoms

The first symptoms include browning and drooping of affected leaves. As the disease spreads into the shoots, they become dry and die. The entire branch can die from the tip downward. Dying branches often have cankers; shallow, slowly spreading lesions surrounded by a thick

area of bark.

Epidemiology

The fungus produces spores on small, pear-shaped pycnidia on dead branches. Spores are spread when splashed by rain and can survive for several weeks on pruned branches left in the field. The fungus usually requires wounded plant tissue to gain entry and initiate infection.

Thorny Stem Blight

Causal organism: *Tunstallia aculeate*

(Ascomycotina, Sphaeriales)

Symptoms

It is caused by *Tunstallia aculeate*. When pruning timing coincided with the sporulation period spread of the disease was higher. There was also a direct correlation between root carbohydrate reserve and disease development. Branches die off. Fruiting bodies (perithecia) project from bark of dead branches giving a thorny appearance. Weak wound parasite.

Management

1. A combination of planting with resistant genotype, cultural control, chemical and biological control measures was found effective.

Flower blight

Causal organism: *Ciborinia camelliae*

Symptoms

It is caused by the fungus *Ciborinia camelliae*. Flower blight appears in early spring when moisture is present and causes the flowers to turn brown. Initially symptoms begin as small, brown, irregular-shaped spots on the flower petals and then quickly enlarge to cover most of the flower. The entire flower turns brown and usually drops within 24 to 48 hours. Only the flowers of the plant are affected.

Management

1. The best control is sanitation.
2. All infected flowers should be pull off and destroy.
3. Gather and remove all leaves, flowers and plant debris that have fallen to the ground.
4. Replace the mulch under the plant.
5. Application of soil drenches, such as PCNB, around the plant in late December or early January is often useful in reducing the intensity of disease.
6. Fungicide sprays viz. Mancozeb and Triadimefon are recommended for the flowers.

Collar Canker

Causal organism: *Phomopsis theae*

Symptoms

The disease is prevalent in young tea and clones are more susceptible than seedlings. Nature of soil is an important factor. Disease incidence was more in Gravelly soil.

Management

1. Deep planting, application of fertiliser near to plant collar and mulching with raw coir pith close to the collar predispose the disease.
2. Soil drenching of the systemic fungicide Carbendazim and application of the same as wound dressing provided satisfactory control.
3. Use of biocontrol agents like *Trichoderma harzianum* and *Gliocladium virens*, were applied both to the soil around the bush and used for wound dressing.

Horse hair blight

Causal organism: *Marasmius crinisequi*

Symptoms

Black fungal threads resembling horse hair are attached to upper branches and twigs by small brown discs. The fungus penetrates and infects the twigs from the discs and produces volatile

substances that cause rapid leaf drop.

Epidemiology

This pathogen is spread from infected twigs to healthy twigs by extending its hair-like threads.

IMPORTANT ROOT DISEASES

1. Red root rot: *Ganoderma pseudoferreum*
2. Brick-red root rot: *Poria hypolateritia*
3. Black root rot: *Rosellinia arcuata* R. *bunodes*
4. Charcoal stump rot, charcoal root, ustulina charcoal rot: *Ustulina deusta* U. *zonata*
5. Diplodia root rot: *Lasiodiplodia theobromae*
6. Armillaria root rot, root splitting disease: *Armillariella mellea*
7. White root rot: *Rigidoporus lignosus*
8. Brown root disease: *Phellinus noxius*
9. Rhizoctonia seedling blight: *Rhizoctonia bataticola*
10. Seedling disease: *Cylindrocladium ilicicola*

Red root rot

Causal organisms: *Ganoderma pseudoferreum* , *G. philippi*

(Basidiomycotina, Hymenomycetes, Aphyllophorales, Ganodermataceae)

Symptoms

Wilt of the plant and dieback. Roots with white surface mycelium which later turns red, to which soil adheres. Rot pale brown and hard, later pale buff and either dry or spongy.

Brick-red root rot

Causal organism: *Poria hypolateritia*

(Basidiomycotina, Aphyllophorales, Polyporaceae).

Symptoms

Root surface white speckled with mycelial strands. These turn into a smooth sheet hardening into plates or ropes of red colour. They show up with scraping or washing.

Black root rot

Causal organism: *Rosellinia arcuata*

(Ascomycotina, Pyrenomycetes, Sphaeriales, Xylariaceae)

Symptoms

Rot of root and stem base, black wood discolouration. White mycelia on roots, later grey to black.

Charcoal stump rot, charcoal root, ustulina charcoal rot

Causal organisms: *Ustulina deusta* U. *zonata*

(Ascomycotina, Pyrenomycetes, Sphaeriales).

Symptoms

No surface mycelium. Under bark of roots white fan-like patches. Wood at base of stem with irregular double lines. Wide host range.

Diplodia root rot

Causal organism: *Lasiodiplodia theobromae*

(Deuteromycotina. Coelomycetes).

Symptoms

Dieback, root and stem-base rot. Blackened vascular system and black discolouration of wood. Large number of host plants.

Armillaria root rot/ root splitting disease

Causal organism: *Armillariella mellea*

(Basidiomycotina, Hymenomycetes, Agaricales).

Symptoms

Severe in Africa and Indonesia, in India rare.

Sudden browning of leaves. Root splitting. White mycelial mat under the bark of stem base and roots, Shoe-string rhizomorphs.

White root rot

Causal organism: *Rigidoporus lignosus*

(Basidiomycotina, Hymenomycetes, Aphyllophorales, Polyporaceae)

Symptoms

Dieback, white mycelium (rhizomorphs) on root. Roots rotten and white. Living wood decaying fungi.

Brown root disease

Causal organism: *Phellinus noxius*

Basidiomycotina, Aphyllophorales, Hymenochaetaceae).

The disease is prevalent in Africa, SE Asia and Australasia.

Symptoms

Adherence of a crust of earth and gravel round the entire root. White or brown mycelium under the bark. Pale dry rot of wood.

Rhizoctonia seedling blight

Causal organism: *Rhizoctonia bataticola*

(Deuteromycotina, Agonomycetes)

Symptoms

The seedlings wilt and dieback. Wide host range. Soil inhabiting fungi.

Seedling disease

Causal organism: *Cylindrocladium ilicicola*

(Deuteromycotina, Hyphomycetes)

Symptoms

Seedlings wilt and dieback. Pantropical, wide host range.

Root Rot

Causal organism: *Phytophthora cinnamomi*

Symptoms

The first symptoms are a uniform leaf yellowing, poor growth and wilting of the entire plant. Infected root systems lack small feeder roots and appear discoloured. Infected roots are reddish brown to dark-brown in colour (healthy roots are white). Death of the plant can occur rapidly, or the plant may remain in a state of decline for several years. All varieties of common tea are susceptible and all varieties of *Sasanqua camelliae* are resistant to this root rot.

Management for root diseases

1. Prevention is very important since this disease is difficult to control once plants are infected.
2. Grafting onto a sasanqua rootstock.
3. Procuring the healthy plants.

4. Choosing locations having a good drainage for planting.
5. Using raised beds to improve the drainage of existing drainage.
6. Application of fungicides containing Etridiazole and Mefenoxam for prevention but will not cure an infected plant.
7. Avoiding burial of prunings in infested field and incorporation of *Trichoderma virens* at 200 g/plant at the time of planting can control black root disease.
8. Isolating the infected area, opening trenches of 1.3 m deep and 45 cm width and uprooting and burning of infected bushes can control the other root diseases.
9. Rehabilitating the soil with Gautemala grass and use of biocontrol agents at 200 g/plant (*Trichoderma harzianum* for red root and root splitting; *T. viride* for black root; *T. harzianum*, *T. viride*, *T. hamatum*, *T. resei* and *T. koningii* for brown rot and *T. virens* for red, brown and root splitting) effectively check the diseases.

BACTERIAL DISEASES

1. Bacterial canker: *Xanthomonas campestris* pv. *theicola*, *X. gortencovianum*
2. Bacterial shoot blight: *Pseudomonas avellanae* pv. *theae*
3. Crown gall: *Agrobacterium tumefaciens*

FUNGAL DISEASES

1. Anthracnose: *Colletotrichum theae-sinensis*
2. Bird's eye spot: *Cercoseptoria ocellata*
3. Black blight: *Cylindrocladium lanceolatum*
4. Black root rot: *Rosellinia arcuata*, *R. bunodes*
5. Black rot: *Ceratobasidium* sp. , *Corticium invisum*, *Corticium theae*
6. Botryodiplodia root rot: *Lasiodiplodia theobromae*
7. Brown blight: *Glomerella cingulata*
8. Brown spot: *Calonectria colhounii*
9. Brown zonate leaf blight: *Ceuthospora lauri*
10. Bud blight: *Phoma theicola*
11. Collar rot: *Rhizoctonia solani*
12. Copper blight: *Guignardia camelliae*
13. Damping-off: *Cylindrocladium floridanum*
14. Gray mold: *Botrytis cinerea*
15. Gray spot: *Phyllosticta dusana*
16. Leaf spot: *Calonectria pyrochroa*
17. Leaf scab: *Elsinoë theae*
18. Macrophoma stem canker: *Macrophoma theicola*
19. Net blister blight: *Exobasidium reticulatum*
20. Pale brown root rot: *Pseudophaeolus baudonii*
21. Phyllosticta leaf spot: *Phyllosticta erratica*
22. Poria root rot and stem canker: *Poria hypobrunnea*
23. Purple root rot: *Helicobasidium compactum*
24. Red leaf spot: *Phoma theicola*
25. Red rust (alga) : *Cephaleuros virescens*
26. Rim blight: *Cladosporium* sp.
27. Rough bark: *Patellaria theae*
28. Sclerotial blight: *Sclerotium rolfsii*
29. Shoot withering: *Diplodia theae-sinensis*
30. Sooty mold: *Capnodium footii*
31. Stump rot: *Irpex destruens*
32. Tarry root rot: *Hypoxylon asarcodes*

33. Twig blight : *Patellaria theae*
34. Twig dieback, stem canker: *Macrophoma theicola*
35. Velvet blight: *Septobasidium bogoriense*
36. Violet root rot: *Sphaerostilbe repens*
37. White scab: *Elsinoe leucospila*
38. White spot: *Phyllosticta theifolia*
39. Xylaria root rot: *Xylaria* sp.

NEMATODE DISEASES

1. Burrowing nematode: *Radopholus similis*
2. Dagger nematode: *Xiphinema insigne*
3. Lance nematode: *Hoplolaimus columbus*
4. Mature tea nematode: *Meloidogyne brevicauda*
5. Pin nematode: *Paratylenchus curvittatus*
6. Reniform nematode: *Rotylenchulus reniformis*
7. Root-knot nematode: *Meloidogyne arenaria*
8. Root lesion nematode: *Pratylenchus brachyurus*
9. Sheath nematode: *Hemicriconemoides kanayaensis*
10. Spiral nematode: *Helicotylenchus dihystrera*
11. Stunt nematode: *Tylenchorhynchus* sp.

PHOTOGRAPHS SHOWING TEA DISEASES



Conclusion

Tea is one of the most important plantation crops growing in India. Due to its perennial nature, management of diseases is difficult. It is infected by several pathogens among which blister blight, dieback, canker, black blight/ thread blight, grey blight, red rust and pink disease are the important ones causing threat to tea production. Management of the diseases are depends on proper diagnosis and timely application of the control measures. The most, effective and sustainable control of the diseases will be obtained when different management strategies were integrated together.

GLOSSARY

- 1. Acervulus:** A mass of closely clustered conidiophores and conidia not covered by fungal tissue, initially subcuticular or subepidermal but eventually exposed (pl. acervuli).
- 2. Blight:** A disease characterised by rapid and extensive death of plant foliage. A general

term applied to any of a wide range of unrelated plant diseases. (e.g., chestnut blight, fireblight, late blight, halo blight).

3. Blotch: A disease characterised by large and irregular in shape, spots or blots on leaves, shoots and stems.

4. Canker: An imprecise term usually used for a plant disease characterised (in woody plants) by the death of cambium tissue and resulting loss and/or malformation of bark, or (in non-woody plants) by the formation of sharply delineated, dry, necrotic, localised lesions on the stem. The term "canker" may also be used to refer to the lesion itself, particularly in woody plants.

5. Dieback: Progressive death of shoots, branches and roots generally starting at the tip.

6. Epidemiology: It is the study of the interrelationships between a given pathogen, the environment and groups or populations of the relevant hosts.

FREQUENTLY ASKED QUESTIONS (FAQS)

Q.1 What is blister blight and its causal organism?

Ans: Blister Blight disease is an important disease of tea and it shows small, pale-green, pale-yellow or pinkish translucent spot on the tea leaf which is readily seen against the light. The causal organism is *Exobasidium vexans*, *E. Camelliae*.

Q.2 What measures can be taken up to control red rust disease of tea?

Ans: Red rust disease of tea can be control by the following ways:

1. Avoid plant stress. Avoid poorly drained sites.
2. Promote good air circulation in the plant canopy to reduce humidity and duration of leaf wetness.

Q.3. Name five important tea root diseases and its causal pathogen.

Ans: Important root diseases of tea and its causal pathogen are listed below. They are:

1. Red root rot: *Ganoderma pseudoferreum*
2. Brick-red root rot: *Poria hypolateritia*
3. Black root rot: *Rosellinia arcuata* *R. bunodes*
4. Charcoal stump rot, charcoal root : *Ustilina deusta* *U. zonata*
5. Diplodia root rot: *Lasiodiplodia theobromae*

Q.4. Explain the symptoms of red rust disease of tea?

Ans: The symptoms of red rust disease of tea are:

- a) Most algal spots develop on the upper leaf surface, red film covering leaves and branches.
- b) Leaves develop lesions that are roughly circular, raised and purple to reddish-brown.
- c) Most algal spots develop on the upper leaf surface.
- d) Older infections become greenish-grey and look like lichen. *Cephaleuros* usually does not harm the plant. The alga produces microscopic, rust-colored, spore-like bodies on the surface of the leaf spots, giving them a reddish tinge.

Q5. Name some nematode diseases of tea?

1. Ans: Some of the nematode diseases of tea are Burrowing nematode, Dagger nematode, Lance nematode, Mature tea nematode, Pin nematode, Reniform nematode, Root-knot nematode and Root lesion nematode.

