

DISEASES OF BLACK PEPPER (*PIPER NIGRUM* L.) AND THEIR MANAGEMENT

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Crop loss due to pest and diseases remains one of the major production constraints in black pepper. Hence a sound knowledge of these and their efficient management would be an essential prerequisite to realise the optimum productivity. In India although 17 diseases of known and unknown etiology have been listed, two major diseases viz., *Phytophthora* foot rot and slow decline take a heavy toll. Anthracnose caused by *Colletotrichum* spp. especially in high altitudes and also stunted disease (earlier known as little leaf disease) are becoming increasingly important in recent years. The studies carried out by National Research Centre for Spices and also Agricultural Universities in Kerala and Karnataka especially on the foot rot and slow decline, resulted in standardisation of efficient disease management measures.

PHYTOPHTHORA FOOT ROT

This is caused by *Phytophthora capsici* ('*P. palmivora*' MF). The fungus is soil borne and infects all parts of black pepper depending on the climatic situations and the cropping system. The disease is noticed in almost all parts in Kerala, Karnataka and Tamil Nadu. Irrespective of the cropping system the general nature of the disease is the same. The disease has got two phases viz., the FOLIAR PHASE and SOIL PHASE. Foliar infections occur and spread during South-west monsoon period especially during intermittent showers. In the soil phase root infection continues even during and after the North-east monsoon upto December as long as the soil moisture regimes remain high, in a given situation.

Symptoms :

Foliar phase : Premonsoon showers initiate new flush formation and major leaf production is noticed upto early August. The fungus infects leaves, spikes and

aerial branches leading to varying degrees of defoliation. On leaf, infection starts as dark water soaked spot which enlarges rapidly during the monsoon period, when high humid conditions and low temperature prevail. The dark brown lesions may be as big as 2-3 cms and two three lesion is noticed. The fungus infects tender spikes causing rotting at any point resulting in spike shedding. Dark brown lesions appear on the tender stems as well as on semi-mature green stems. The leaves beyond the point of infection, start dropping and are shed and occasional die-back symptoms are noticed. Foliar infection may not kill the vine but debilitated the vines because of varying degrees of defoliation.

Disease spread :

Foliar infections are seen in pure plantation as well as mixed plantations. With the onset of monsoon, soil moisture builds up and the dormant fungus propagules germinate leading to the population build up. The tender runner shoots lying on the ground and also the leaves which are in the lower region of the bush are the ones which are infected first. This happen because of the soil splashes which carry fungal inoculum. The infected shoots and leaves produce abundant sporangia. With intermittent showers the sporangia release zoospores and get splashed on to the foliage. Thus, the infection gradually spreads upwards as long as intermittent rainfall continues. The foliar infection results in leaf shedding and spike shedding.

Soil phase : Both foot rot and root infections are serious and are fatal.

Root infection :

With the onset of monsoon new root production takes place. With the build up of soil moisture, the active fungal propagules infect the feeder root system and this infection gradually spreads to adjacent roots. Once

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the feeder root system is rotten it spreads to thicker roots. The affected vines exhibit foliar yellowing. Root infection stops with depletion of soil moisture. Root infection gradually leads to weakening of the plant. The health of the vine is determined by the root loss to root regeneration. Root infection finally leads to collar infection.

Collar or foot infection :

Infection on the runner shoots might reach the collar or root (stem at the ground level). Root infection finally might culminate in collar infection. However, independent collar infection also might occur. The infection at the collar appear as dark patch which later becomes slimy. The rotting advances deep into the tissues and it spreads both upward and downward girdling the stem. This blocks the movement of water and mineral salts, creating stress condition. Foot rot infection causes foliar yellowing to start with, and gradually increases. The leaves of the affected vines droop and branches break off at nodes exhibiting typical stress symptoms. Occasionally without showing any foliar yellowing the plant suddenly wilts. Collar infection finally leads to death of the plant.

SLOW DECLINE DISEASE

This is a debilitating disease and is considered to be fungal nematodal complex coupled with malnutrition and moisture stress. Foliar yellowing, leaf tip burn and root rot are the major symptoms of the disease.

Nematodes :

Radopholus similis, the burrowing nematode, is an endoparasitic nematode which infects the feeder root system causing linear lesions. These lesions merge leading to varying degrees of feeder root damage. *R. similis* is identified as banana race. Root knot nematode, the *Meloidogyne incognita* infects the root, causing root galls of varying sizes. Combined infection by both the nematodes leads to root generation, thus weakening the vine resulting in slow decline symptom. Foliar yellowing intensifies as the root degenerated and with depletion of soil moisture during December to April period. With the onset of monsoon, some of the affected vines recover probably due to fresh root regeneration.

Field experiments conducted at National Research Centre for Spices, inoculating pepper plants with *R. similis* and *M. incognita* alone and in combination, showed majority of the above symptoms indicating the potentiality of these nematodes in causing root damage leading to slow decline.

A holistic approach :

Independent infections caused by *P. capsici* and plant parasitic nematodes might occur. However, in a single plantation both the diseases are noticed. As such spatial separation of both *Phytophthora* and plant parasitic nematodes might not exist in field condition. Hence the efforts should be to knock down the major pathogens viz., *P. capsici*, *R. similis* and *M. incognita* and to boost up the health and vigour of the vines. Any single method to contain these diseases was found unsuccessful. However, an integrated approach involving cultural, chemical and bio-control methods coupled with host resistance would be an ideal strategy to tackle these disease problems.

Host resistance :

National Research Centre for Spices has identified Narayakodi, Kalluvally, Uthirankotta and Ballankotta as the *Phytophthora* tolerant cultivars. A cultivar 'Ottaplackal' resistant to root-knot nematode has been identified. Karimunda cultivar though productive is highly susceptible to foot rot disease. It is also a common observation that disease incidence and its spread is much less in plantation with a mixture of cultivars and it is mostly mono-culture of susceptible types like Karimunda often results in severe disease incidence. Hence, cultivation of multi-lines is the suggested strategy until the evolution of cultivars with high degree of resistance and productivity.

Disease management :

The following proven package for efficient disease management is suggested. Though it may slightly differ from pure cropping system to mixed cropping system, the general principles remain the same. In the case of coffee-black pepper mixed cropping system in Coorg, it is mainly root infection which is generally noticed although foliar infection cannot be ruled out. Location specific decisions have to be taken, depending on the type of infection i.e., either foliar or root infection in order to reduce the plant protection

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cost. Even where foliar infection caused by *P. capsici* is not a problem, foliar spray with bordeaux mixture (1 per cent) is essential to check anthracnose infection which is highly prevalent in high altitudes in Coorg district.

Cultural practices :

- * **Phytosanitation:** Remove infected and dead vines along with root stem from the plantation and burn to check the population build up of the pathogens. Drench the soil with 51 of copper oxychloride (0.2 per cent).
- * Provide good drainage in the plantation where the plantation is prone for water stagnation.
- * Maintain legume or grass cover in plantations to reduce soil splash and consequent foliar infection.
- * Lop off branches of live standards to ensure better light penetration and to reduce humidity build up in a plantation.
- * Prune off tender runner shoots/leaves and hanging shoots which are touching the soil to reduce the chances of infection. Tie them erect to the standard.
- * Practice minimum tillage concept to avoid injury to the root system.
- * Avoid frequent movement of personnel from diseased garden to healthy gardens.
- * Replant atleast one year after the removal of the dead vine, Plant disease-free rooted cuttings in the pits. Burn dry trash in the pits and later drench with 0.2 per cent copper oxychloride, 15 days prior to planting.
- * Apply neem oil cake as a soil amendment @ 1kg/ vine during May-June, which has a suppressive action both on nematodes and *Phytophthora*, apart from its source as nutrient.

Chemical control :

- * Spray the vines with Bordeaux mixture (1 per cent), drench the basins with 3 - 5 litres of copper oxychloride (0.2 per cent) or 1 per cent bordeaux mixture, once as a pre-monsoon treatment (August-September). The quantity of copper

oxychloride depends upon size of canopy. Apply bordeaux paste to the collar upto 30 cm to check collar infection.

- * Spray the vines with Ridomil MZ 72 WP (1.25 g/1) and also drench the base of the vine (@51/vine) by skipping one of the above bordeaux mixture treatment.
- * A third round of soil drenching with copper oxychloride/bordeaux mixture can be given during October if north-east monsoon continues.
- * Fork in 30 g of phorate (Thimer 10 g) into the soil around the vine during May-June and repeat the same during August-September to check nematodes.

Precautions :

- * Mild foliar yellowing is an indication of root infection and needs a careful watch and prompt action.
- * Presence of runner shoot infection or leaf infection is a warning signal to note that *Phytophthora* is active.
- * Timely application of fungicide/nematicide is important and application at advanced stages of infection would be ineffective. The time differs from place to place depending on earliness of monsoon showers.
- * Resort to foliar spray at maximum foliage emergence.
- * Adequate solid moisture should be ensured at the time of nematicide application.
- * Avoid using runner shoots from diseased gardens as planting materials.

ANTHRACNOSE DISEASE

This is known as 'pollu' disease in Malayalam and is prevalent in many of the plantations. The infected berries do not develop and dry up forming chaffey berries and hence the name hollow (pollu) berry.

Symptoms :

Colletotrichum gloeosporioides causes yellowish brown angular lesions on the leaves and also infect berries at different stages of the development. If infection

occurs at the early stages of berry development, further development is arrested. When infection occurs on mature or semi-mature berries, a crack develops on the berry.

A new type of anthracnose disease is noticed in high altitudes of Kerala and Karnataka especially in Wynad and Coorg districts. The infection causes reddish brown, round lesions both on semi-mature and tender leaves. When it infects in severe form, the leaves become distorted and crinkled. It also infects tender stems causing occasional blighting. The most important is the spike infection causing large scale spike shedding during May-June period before the onset of the heavy monsoon. Spike shedding ranges from 5-25 per cent causing considerable loss.

Etiology and epidemiology :

In view of the minor incidence no detailed studies were carried out. Infection is noticed in mild form throughout the year. Infection of *C. gloeosporioides* is seen in severe form during September-October period. However, the new leaf spot disease caused by *Colletotrichum* sp. causes greater damage during May-June period resulting in heavy spike shedding. The leaf spots are noticed on older leaves in a milder form throughout the year.

This would ensure the presence of inoculum throughout the year. The infection is also noticed in coconut based mixed cropping system when black pepper becomes one of the main components of the system. Considerable variation in severity was noticed in different varieties.

Disease management :

Pre-monsoon foliar spraying with 1 per cent bordeaux mixture could check the infection effectively. According to the planters in Coorg, it is very effective, if done at a correct time especially coinciding with spike emergence.

STUNTED DISEASE (LITTLE LEAF DISEASE)

This disease is prevalent not only in India but also in Sri Lanka, Malaysia and Indonesia. It is known as little leaf disease in India earlier. In a recently concluded International Workshop on Black Pepper Disease on

Lampung, Indonesia, it has been designated as stunted disease of black pepper for uniformity of the terminology in all IPC member countries.

The disease was first noticed in District Agricultural Farm, Neriampalam, Idukki District, Kerala during 1975 and subsequently seen in Wynad District and several parts of Idukki district.

Symptoms :

In a single vine both disease affected and healthy branches are noticed. The leaves appear small, leathery, crinkled with chlorotic patch/streaks. In severe cases the leaves become abnormally narrow giving sickle shaped appearance. The internodal distance becomes narrow, and the plants becomes stunted in appearance.

Nature of the disease :

The investigation so far conducted ruled out the involvement of pathogenic fungi and bacteria. However, cuttings raised from infected plants showed typical disease symptoms, thereby indicating the systemic nature of the disease. It is suspected to be caused by Mycoplasma like organism (MLO's) of a virus.

Disease management :

In view of the unknown etiology of the disease, phased eradication of disease affected vines is suggested.

- * Raising cuttings from apparently healthy runner shoots from affected vines and apparently normal vines in the vicinity of the disease affected vines should be avoided.
- * Such diseased planting materials in nurseries should be uprooted and destroyed.
- * Infected vines in the garden should be uprooted and burnt to reduce the disease spread, since such vines serve as source of inoculum.
- * Movement of the planting materials from infected regions to disease free zones should be avoided.

Correct identification of the disease problem and timely plant protection measures would help in checking the disease incident in black pepper.