Wilt Disease of Guava: An overview

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Guava (Psidium guajava Linn.) is one of the important fruits of our country with a total production of 3668 thousand MT and an average productivity of 13.7 MT/ha, it is farmed on an area of about 268 thousand ha. But the yield of guava is heavily affected by various disease and pests. Wilt is a major disease that is challenging to control. This disease causes a yield loss of 5-60% in India. The disease shows yellow discolouration of leaf with little curling on terminal branches but later browning, drooping and pre-mature shedding of leaves. Black streaks are observed on finer roots of the infected plants. The disease is mainly caused by Fusarium oxysporum f. sp. psidii. Highest severity is observed in temperature ranges 23-32 °C with 76% RH. The disease can be managed by various management practices including integrated disease management.

Introduction

Guava (*Psidium guajava* Linn.) is one of the important fruits of our country. It is known as the "poor man's apple" since it is affordable, wholesome, and widely accessible. Guavas are grown practically everywhere in India, mainly in tropical areas having dry and humid heats. Its fleshy fruit and the leaves both are edible, fruit most often eaten as snack and their leaves generally used as herbal tea. Guava is rich in nutrients. Guava has been found to have several health advantages and has more vitamin C than oranges in addition to being a great source of other antioxidants. Fruit is helpful to improve digestion, immune system and guava leaf tea benefited as diarrhoea treatment, lowering blood sugar and other antimicrobial effects.

With a total production of 3668 thousand MT and an average productivity of 13.7 MT/ha, it is farmed on an area of about 268 thousand ha. With the biggest acreage in Uttar Pradesh (45.0 thousand ha), followed by Maharashtra (40.0 thousand ha), and Bihar (30.0 thousand ha), it is a crop that can be produced easily in all types of soil and nearly all of India's states. The state of Madhya Pradesh claimed the highest productivity, or 37.6 MT/ha. The guava plant is susceptible to numerous diseases, including pre- and post-harvest fruit rots, canker, wilt, dieback, defoliation, twig drying, leaf spot, leaf blight, anthracnose, red rust, sooty mould, rust, seedling blight, and damping-off. But among the most important disease is wilt which difficult to diagnose and management is also very tough.

Historical background and geographical distribution

Guava wilt was first reported in Allahabad in 1935. The disease was later detected in guava orchards in West Bengal, but its occurrence was primarily confined to specific regions. It was observed in the Gangetic alluvial soils of the Baruipur area in South 24 Parganas district, the laterite zone of Jhargram, and certain locations in the eastern and western parts of Midnapur, as well as in Bankura district.

Losses

Various researchers have estimated losses caused by wilt disease in guava using different parameters. As wilt is a destructive disease of guava that causes 5-60 per cent loss in guava production in India.

Symptoms

Symptoms of wilt of Guava is generally confusing. Any plant cannot be termed as wilt. Wilting and death of the plant may be due to many reasons like infestation of various pests like termite, stem borer, bark-eating, caterpillar, root grubs etc. and other reasons like mechanical damage by farm implements or water stress etc. But infection by wilting fungus shows some specific symptoms that are discussed below.

Initially yellow discolouration with little curling of leaf is seen on terminal branches but later browning, drooping and pre-mature shedding of leaves occur. On the affected branches, fruits remain under developed, hard and stony. As leaf sheds from the plant but hard and stony, dark brown to black fruits remains for some time. Discolouration and black streaks are observed on finer roots of the infected plants. On removing the bark, it becomes more prominent.

Vascular tissues show light brown discolouration in roots. Stem of the plant also damaged by the plant. Wilted plants eventually exhibit bark splitting. The pathogen affects both young and mature fruit-bearing trees, with older trees being more susceptible to the disease (Fig. 1).

Drying and curling of plants **Wilting of Plant**

Fig 1: Symptoms of Guava wilt (*Source*: https://blog.fasal.co/2023/01/31/major-diseases-of-guava-fusarium-wilt-and-anthracnose/)

Causal organism

Disease complexes are formed by an association of two organisms that infect a crop at the same time causing significant loss in yield. Many scientists have reported many pathogen associations with this disease like- *Fusarium oxysporum f. sp. psidii, F. solani, Macrophomina phaseoli, Rhizoctonia bataticola, Gliocladium roseum, G. vermoesenii, Cephalosporium* sp., *Verticillium albo-atrum and Acremonium* sp. In West Bengal, both *Macrophomina phaseoli* (Maubl.) Ashby and *Fusarium solani* (Mart.) Sacc. were found to incite the wilt either individually or in combination.

Interaction of wilt pathogen with nematodes

Microscopic worms known as plant-pathogenic nematodes are wreaking havoc on guava trees. These insidious pests weaken the trees, making them more susceptible to secondary attacks by wilt fungus. This creates a "disease complex" where the combined

effects of both pathogens are far more damaging than either one alone. When wilted guava trees are uprooted, researchers have observed numerous galls on the roots, a sign of the combined infection by both the nematode (which feeds on vascular bundles) and the fungus. Among the nematodes, *Meloidogyne* species are particularly troublesome. With their wide host range and ability to inflict significant damage, they pose a major threat to guava production.

Epidemiology

Maximum and minimum temperature ranges 23-32 ℃ with 76% RH are conducive for the pathogen to cause guava wilt. More disease is observed in clay loam and sandy loam as compared to other soil types. Wilt incidence is severe in alkaline soils with a pH range of 7.5 to 9.0. However, a high occurrence of the disease has also been reported in lateritic soils with a pH of 6.5.

Disease management

- Guava wilt is an extremely serious disease that is carried by the soil, making it challenging to treat once symptoms show up on plant leaf.
- Tillage during monsoon enhance wilt incidence. Therefore, tillage should be avoided during the monsoon season and up until December.
- As the disease is soil borne in nature, flood irrigation spreads the disease. Hence, separate basin irrigation or drip irrigation should be encouraged for the management of disease.
- These cultural practices are useful and should be adopted for integrated management practices as important component.
- Due to the soil-borne nature of the wilt pathogen, chemical control methods are impractical.
- Furthermore, chemical treatments pose significant risks to soil health and the environment. As their effectiveness diminishes, the pathogen may become more aggressive and virulent.
- Considering these factors, the use of bio-agents is regarded as a more effective strategy for managing wilt disease. Biocontrol involves reducing pathogen inoculum or disease activity through interactions with beneficial organisms. It employs natural or modified organisms, genes, or gene products to mitigate the impact of pests and diseases.
- Another promising approach to disease management is the application of botanical fungicides. Plants contain biodegradable secondary metabolites, many of which have been found to inhibit various phytopathogenic fungi. Fungicides derived from plant-based compounds are environmentally friendly and have demonstrated effectiveness in controlling several plant diseases. Excessive and improper use of synthetic fungicides has contributed to pathogen resistance, environmental pollution, and food contamination due to toxic residues.

Some effective management practices against wilt pathogens of guava:

Management Practices	Strategies
Cultural	Soil treatment with gypsum Proper sanitation (wilted trees should be uprooted, burnt and trench should be dug around the tree trunk) Maintenance of proper tree vigour by timely and adequate manuring, inter-culture and irrigation enable them to withstand infection Intercropping with turmeric or marigold Less tilled orchards
Biological	*Aspergillus niger* (AN 17) *Aspergillus flavus, Aspergillus luchuensis, Penicillium chrysogenum*, *Aspergillus niger, Trichoderma* species (*T. virens, T. harzianum, T. viridae*), *Penicillium citrinum* *Bacillus amyloliquefaciens* and *Pseudomonas fluorescens* *Paenibacillus polymyxa* HX-140 Use of VAM symbiont at the rate of 5 kg tree^{-1} is very beneficial
Botanicals	*Azadirachta indica, Lantana camera, Ocimum sanctum, Datura fastosa, Ficus religiosa, Atropa belladonna, Calotropis procera, Eucalyptus amygdalina, Alianthus excels, Vinca rosea, etc.* *Eugenia caryophyllata, Trachyspermum captivum* and *Moringa oleifera*
Chemicals	Chaubatia paste, water-soluble 8- Quinolinolsulphate, Benlate or Bavistin, Metasystox and Zinc sulphate, Thiophanate methyl, Captafol and Thiabendazole Spraying mixture of Diamonium phosphate and Zinc sulphate Tebuconazole, propiconazole, prochloraz, Triforine and Carbendazim + Flusilazole and Carbendazim 50% WP

Integrated disease management

Considering the complexity of the problem, integrated eco-friendly approach for the management of guava wilt is suggested by different scientists.

- ***Rootstock selection***: Utilize resistant rootstocks, such as hybrids of *P. molle* and *P. guajava*, which naturally offer increased disease tolerance.
- ***Beneficial microbes***: Introduce bioagents like *Aspergillus niger*, *Trichoderma* spp., or *Penicillium citrinum* at planting and annually incorporate them into the enriched farmyard manure (FYM) before monsoon season. These beneficial organisms help suppress harmful pathogens in the soil.
- ***Intercropping***: Plant marigolds or turmeric alongside guava trees. These companion plants can deter harmful nematodes and promote beneficial microbial communities.
- ***Organic amendments***: Apply neem cake and gypsum to the soil. Neem cake possesses antifungal properties, while gypsum improves soil drainage and calcium content, both contributing to plant health.
- ***Minimize soil disruption***: Practice minimum tillage, particularly during the monsoon season, to avoid disturbing potential fungal spores in the soil.
- ***Water management***: Utilize drip irrigation or separate basin irrigation to minimize waterlogging around the roots, creating an unfavourable environment for fungal growth.

- ***Maintain optimal plant density***: Control plant population by avoiding overcrowding, ensuring proper air circulation and reducing disease spread.
- ***Orchard hygiene***: Maintain good sanitation by removing and destroying wilted plants, infected plant debris, and fallen leaves to prevent further spread of the disease.

Implementing these integrated, eco-friendly practices can effectively manage guava wilt disease and ensure sustainable guava production.

Conclusion

Guava wilt that is caused by a complex of fungal and nematode pathogens, poses a significant threat to guava production in India as well as worldwide. This devastating disease weakens trees, leading to stunting, wilting, and ultimately death. However, several management strategies can be employed to combat this disease and protect guava trees.