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## Little Leaf Disease of Brinjal: Symptoms, Spread and Integrated Management

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Brinjal or eggplant (*Solanum melongena* L.) is one of the most important vegetable crops cultivated extensively in India and many other tropical and subtropical countries. The crop is valued for its nutritional richness, adaptability to different climatic conditions and regular income generation for farmers. However, brinjal production is greatly affected by several pests and diseases, among which little leaf disease is considered one of the most destructive diseases limiting crop productivity. The disease causes severe abnormalities in plant growth and development, leading to significant reduction in fruit yield and quality. Infected plants produce very small and narrow leaves, excessive branching, shortened internodes, bushy appearance and malformed or poor-quality fruits. In severe cases, infected plants may fail to produce marketable fruits, resulting in heavy economic losses to farmers. The disease is caused by phytoplasma, a microscopic wall-less pathogen that survives inside the phloem tissues of plants. The disease spreads mainly through sap-sucking leafhopper insects, especially *Hishimonus phycitis*. Warm temperature, high humidity, presence of weeds and poor field sanitation favour rapid multiplication of insect vectors and disease spread. Since infected plants cannot be cured completely after infection, early detection and preventive management practices are essential for reducing disease incidence. Integrated disease management practices such as use of healthy seedlings, rouging of infected plants, weed removal, management of leafhopper vectors and maintenance of field sanitation are effective in minimizing disease spread. This article highlights the symptoms, spread, epidemiology and integrated management of little leaf disease of brinjal in a simple and farmer-friendly manner for sustainable crop production.

**Keywords:** Brinjal, Little leaf disease, Phytoplasma, Leafhopper, *Hishimonus phycitis*, Disease management, Eggplant

### Introduction

Brinjal or eggplant (*Solanum melongena* L.) is one of the oldest cultivated vegetable crops belonging to the family Solanaceae. It is widely grown in tropical and subtropical regions because of its adaptability, continuous harvesting nature and wide use in daily cooking. Brinjal is used in the preparation of curries, fries, chutneys, pickles and several traditional dishes. It is rich in carbohydrates, fibre, vitamins, minerals and antioxidant compounds such as phenols and anthocyanins which are beneficial for human health (Daunay and Janick, 2007). Brinjal is also considered an important protective food due to its nutritional and medicinal value (Kumari *et al.*, 2019). India is one of the leading producers of brinjal in the world and the crop is cultivated extensively in states such as Telangana, West Bengal, Odisha, Bihar, Gujarat, Andhra Pradesh, Karnataka and Tamil Nadu. Farmers prefer brinjal cultivation because it provides regular harvests and regular market returns throughout the year (Anonymous, 2024). Despite its importance, brinjal cultivation is affected by several insect pests and diseases which reduce crop yield and quality. Among them, little leaf disease

is one of the most serious diseases causing severe economic losses in many brinjal-growing regions. Infected plants become stunted and fail to produce marketable fruits. Under severe conditions, yield losses may range from 30 to 100 percent depending on disease severity and crop stage (Nariani and Vasudeva, 1968). Phytoplasma diseases are emerging as major constraints in vegetable cultivation worldwide due to their rapid spread and difficulty in management (Kumari *et al.*, 2019).

### Cause of the Disease

Little leaf disease of brinjal is caused by a tiny disease-causing organism called phytoplasma. Earlier, these organisms were known as Mycoplasma-like Organisms (MLOs). The scientific name of the pathogen is *Candidatus Phytoplasma trifolii*. Phytoplasmas live inside the food-conducting tissues of plants and interfere with normal movement of nutrients and plant growth substances, resulting in abnormal plant growth (Lee *et al.*, 2000). Several phytoplasma groups are associated with little leaf disease of brinjal. Studies conducted in India revealed that the 16SrVI-D phytoplasma group is commonly associated with the disease (Kumar *et al.*, 2017). Since phytoplasmas cannot be grown on artificial media, advanced molecular techniques such as Polymerase Chain Reaction (PCR) and sequencing are used for accurate detection and identification (Bertaccini and Duduk, 2009).

### Symptoms of Little Leaf Disease

Farmers can identify little leaf disease easily in the field through characteristic symptoms. The most common symptom is the production of very small and narrow leaves. The leaves become pale green or yellowish and sometimes leathery in texture. Infected plants show excessive branching and develop a bushy appearance commonly known as “witches’ broom” (Rao *et al.*, 2017). Internodes become very short resulting in severe stunting of plants. Flower parts may become green and leaf-like, a condition known as phyllody. Fruits become small, hard, and malformed. In severely infected plants, fruits may not develop at all. Other symptoms such as chlorosis, virescence and malformed calyx have also been reported in advanced stages of infection (Karthikeyan *et al.*, 2024). When infection occurs during early stages of crop growth, complete crop failure may occur due to absence of fruit formation (Maheshwari *et al.*, 2017).



Fig. 1. Brinjal plants showing typical little leaf symptoms

### Vector and Disease Spread

Little leaf disease in brinjal is mainly transmitted by leafhopper insects that feed on plant sap. Among them, *Hishimonus phycitis* is considered the most important vector responsible for disease transmission in brinjal fields (Kumar *et al.*, 2017). The insect acquires the phytoplasma while feeding on infected plants and later transmits it to healthy plants during sap feeding. Both nymphs and adult leafhoppers are capable of spreading the disease. The disease spreads more rapidly during warm and dry weather conditions, which favour multiplication of leafhopper populations. Higher vector activity during the summer and early monsoon seasons often results in increased disease incidence in brinjal-growing areas. Once the insect acquires the phytoplasma, it can transmit the pathogen to several healthy plants throughout its lifespan. Young plants are highly susceptible to infection. When infection occurs at an early stage, plants become severely stunted and show excessive branching, reduced leaf size, and failure of flowering and fruit formation. Such infected plants remain unproductive and result in heavy yield losses. The movement of infected seedlings from nurseries to farmers’ fields is another important source of disease spread. Planting infected seedlings introduces the disease into new areas, where leafhoppers further spread it rapidly within the crop. Hence, raising healthy and disease-free seedlings is very important.

The presence of weeds and alternate host plants around the field also favours disease development. Weeds such as *Portulaca oleracea*, *Parthenium hysterophorus*, and some solanaceous weeds can harbour the phytoplasma and serve as reservoirs of the pathogen during the off-season. These weeds also provide shelter and food for leafhopper vectors, helping the vectors survive between cropping seasons. Continuous cultivation of brinjal in the same field increases the chances of disease build-up. Lack of crop rotation and poor field sanitation allow both the pathogen and insect vector to survive for longer periods. Dense planting and poor weed management further encourage vector multiplication and disease spread. In severe cases, the disease can spread rapidly from plant to plant and affect large areas of the field within a short period, leading to serious yield losses. Therefore, timely management of leafhopper vectors, removal of infected plants, and proper field sanitation are essential to minimize the spread of little leaf disease in brinjal.

### Conditions Favouring Disease Development

The disease spreads rapidly under favourable environmental conditions. Warm temperature, moderate humidity and high leafhopper population encourage rapid disease transmission. Disease incidence is generally higher during warmer months when vector activity is high (Srivastava and Mall, 2024). Poor field sanitation, delayed insect management and presence of infected weeds also increase disease incidence. Surveys conducted in Tamil Nadu reported disease incidence ranging from 22 to 27 percent under favourable conditions depending on season and vector population (Karthikeyan *et al.*, 2024).

### Diagnosis of the Disease

Disease symptoms can usually be identified visually in the field. However, sometimes symptoms may resemble nutrient deficiency or viral infections. Therefore, advanced molecular methods are used for accurate diagnosis. PCR-based detection using phytoplasma-specific primers targeting the 16S rRNA gene is widely used for confirmation of phytoplasma infection (Das *et al.*, 2000). Fluorescence microscopy and electron microscopy are also used to observe phytoplasma bodies within infected plant tissues (Doi *et al.*, 1967).

### Integrated Disease Management

Since infected plants cannot be cured completely after infection, integrated disease management practices are essential to reduce disease spread and crop loss.

#### 1. Use Healthy Seedlings

- Always use healthy and disease-free seedlings for transplanting.
- Avoid planting seedlings showing abnormal growth or small leaves.
- Recent studies indicated the possibility of phytoplasma transmission through infected seedlings, highlighting the importance of selecting healthy planting material (Contaldo *et al.*, 2024).

#### 2. Remove Diseased Plants

- Regularly inspect the field and remove infected plants immediately to prevent further spread of the disease.
- Early rouging of infected plants helps protect healthy plants from infection.

#### 3. Vector Monitoring and Cultural Management

- Install yellow sticky traps in the field for monitoring and trapping leafhopper insects.
- Raise border rows of maize or bajra around the field one month before transplanting to reduce movement of leafhopper vectors.
- Use silver-black polyethylene mulch of 25-micron thickness to reduce vector infestation.

#### 4. Chemical Management

- Farmers are advised to spray recommended insecticides such as imidacloprid, thiamethoxam, or dimethoate at proper intervals to reduce vector population (Singh and Kumar, 2012).
- Treat seeds with imidacloprid @ 3 g/kg seed before sowing.

- Dip seedlings in imidacloprid @ 3 ml/L water or tetracycline solution @ 100 ppm before transplanting.
- Start foliar sprays from 20 days after transplanting (DAT) and repeat at 20-day intervals before first fruit formation.
- Spray imidacloprid @ 0.03% + neem oil @ 0.2% for effective vector control.
- Alternate sprays with thiamethoxam @ 0.3% or acetamiprid/flonicamid as recommended to avoid development of insecticide resistance.
- Spray tetracycline @ 150–200 ppm along with micronutrient mixture to reduce symptom severity and improve plant vigour.

#### 5. Remove Weeds

- Remove weeds regularly from the field and surrounding areas, as they serve as alternate hosts for both phytoplasma and leafhopper vectors.

#### 6. Follow Crop Rotation

- Avoid continuous cultivation of brinjal in the same field.
- Crop rotation with non-solanaceous crops helps reduce disease carryover and vector survival.

#### 7. Maintain Field Sanitation

- Maintain proper field sanitation by removing infected plant debris and keeping the field clean.
- Balanced fertilizer application and proper irrigation improve plant vigour and reduce disease severity.

#### 8. Use Resistant or Tolerant Varieties

- Scientists are working on developing resistant and tolerant brinjal varieties against little leaf disease.
- Farmers should prefer tolerant varieties whenever available (Karthikeyan et al., 2024).

Integrated disease management involving healthy seedlings, vector control, weed removal, and proper field sanitation is considered the most effective approach for minimizing little leaf disease in brinjal (Bertaccini and Duduk, 2009).

### Conclusion

Little leaf disease is one of the most destructive diseases affecting brinjal cultivation and causes severe reduction in plant growth and fruit yield. The disease is mainly transmitted by the leafhopper vector *Hishimonus phycitis* and spreads rapidly under warm climatic conditions. Production of small and narrow leaves, bushy growth, shortened internodes and poor fruit formation are the major symptoms of the disease. Since infected plants cannot be cured completely, emphasis should be given to preventive and integrated disease management practices. Farmers can effectively reduce disease incidence by using healthy seedlings, removing infected plants, controlling leafhopper insects, removing weeds and maintaining proper field sanitation. Regular field monitoring and timely management practices are essential to minimize disease spread and improve brinjal productivity and enhance farmer income.

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