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Some Important Plant Pathogenic Disease of Brinjal (*Solanum melongena* L.) and their Management

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Abstract: The eggplant (*Solanum melongena*) is one of the most widely grown vegetable crops all over the world, including the Indian sub-continent. This crop is prone to massive attacks by several species of fungi and bacteria that cause wilt, soft rot and root rot because of the increasing restriction in the use of chemical fungicides due to concern for the environment and human health, microbial inoculants have been experimented extensively during the last decade to control wilt and other plant diseases. Bacteria have been explored as biocontrol agents for plant and also as plant growth promoters and inducers of disease resistance. Apart from improving plant health, they also meet the increasing demand for low-input agriculture. The purpose of this study is to describe some important disease of brinjal and their management.

Key words: Brinjal, management, pathogen, management

INTRODUCTION

Brinjal or eggplant (*Solanum melongena* L.) is an important solanaceous crop of sub-tropics and tropics. The brinjal, eggplant or Aubergine (French name) has originated in the Indian sub-continent and China (Thompson and Kelly, 1957; Purewal, 1957; Martin and Rhodes, 1979). Brinjal is an important vegetable crop of the Far East, Bangladesh, India, China and the Philippines. The name brinjal is popular in Indian subcontinents and is derived from Arabic and Sanskrit whereas the name eggplant has been derived from the shape of the fruit of some varieties which are white and resemble in shape to chicken eggs. It is also called aubergine (French word) in Europe. According to the 1994 FAO Production Year book, the world eggplant production areas were 556,000 ha and the total production was 8,979,000 mt. Asia has the largest eggplant production which comprises more than 90% of the world production area and 87% of the world production. (The data did not include India and Bangladesh). Gill and Tomar (1991) reported 299,770 ha of eggplant production area in India and 29,150 ha in Bangladesh in 1992-1993, bringing the Asian total close to 830,000 ha. The brinjal is of much importance in the warm areas of Far East, being grown extensively in India, Bangladesh, Pakistan, China and the Philippines. India is considered to be the centre of origin of cultivated brinjal, from where it spread to the other parts of the world (Choudhury and Malda, 1968) it is also popular in Egypt,

France, Italy and United States. In India, it is one of the most common, popular and principal vegetable crops grown throughout the country except higher altitudes. It is a versatile crop adapted to different agro-climatic regions and can be grown throughout the year. It is a perennial but grown commercially as an annual crop. A number of cultivars are grown in India, consumer preference being dependent upon fruit color, size and shape.

The varieties of *S. melongena* L. display a wide range of fruit shapes and colours, ranging from oval or egg-shaped to long club-shaped; and from white, yellow, green through degrees of purple pigmentation to almost black. Most of the commercially important varieties have been selected from the long established types of the tropical India and China. Brinjal fruit (unripe) is primarily consumed as cooked vegetable in various ways and dried shoots are used as fuel in rural areas. It is low in calories and fats, contains mostly water, some protein, fiber and carbohydrates. It is a good source of minerals and vitamins and is rich in total water soluble sugars, free reducing sugars, amide proteins among other nutrients. Brinjal or eggplant (*S. melongena* L.) is an important solanaceous crop of sub tropics and tropics. It is also called Aubergine (French word) in Europe. The brinjal is of much importance in the warm areas of Far East, being grown extensively in India, Bangladesh, Pakistan, China and the Philippines. It is also popular in Egypt, France, Italy and United States. In India, it is one of the most

common, popular and principal vegetable crops grown throughout the country except higher altitudes. It is a versatile crop adapted to different agro-climatic regions and can be grown throughout the year. It is a perennial but grown commercially as an annual crop. A number of cultivars are grown in India, consumer preference being dependent upon fruit colors, size and shape. Brinjal is considered a native to India where the major domestication of large fruited cultivars occurred. In "Origin of cultivated plants" published in De Candolle (1986), stated that the species *S. melongena* has been known in India from ancient times and regarded it as a native of Asia. Vavilov (1928) was of the opinion that its centre of origin was in the Indo-Burma region. Various forms, colours and shapes of brinjal are found throughout South-East Asia, suggesting that this area is an important centre of variation. A centre of diversity is believed to be in the region of Bangladesh and Myanmar (Former India-Burma border). Evidence to this was given by Isshiki *et al.* (1994) based on the isozyme and morphological variation noticed in large germplasm collection from India. According to Zeven and Zhukovsky (1975), it originated in India but spread eastward and by the 5th century B.C. was in China which became a secondary centre of variation. Thus, it has been known for the last 1500 years in China. Arabic traders were responsible for subsequent movement to Africa and Spain. Brinjal cultivation in the Mediterranean region is relatively recent. Portuguese colonies took it to Brazil. It is now widely cultivated for its fruits in the tropical, subtropical and warm temperate zones, especially in Southern Europe and the Southern United States.

Sampson (1936) suggested the African origin of this crop but there is no evidence that *S. melongena* is native there though there are spiny African brinjal plants. It has been reported that on an average, the oblong-fruited eggplant cultivars are rich in total soluble sugars, whereas the long-fruited cultivars contain a higher content of free reducing sugars, anthocyanin, phenols, glycoalkaloids (such as solasodine), dry matter and amide proteins (Bajaj *et al.*, 1979). High anthocyanin content and low glycoalkaloid content are considered essential, regardless of how the fruit is to be used. For processing purposes, the fruit should have a high dry matter content and a low level of phenolics. Bitterness in eggplant is due to the presence of glycoalkaloids which are of wide occurrence in plants of Solanaceae family. The glycoalkaloid contents in the Indian commercial cultivars vary from 0.37 mg/100 g fresh weight to 4.83 mg (Bajaj *et al.*, 1981). Generally, the high content of glycoalkaloids (20 mg/100 g FW) produce a bitter taste and off flavor.

The discoloration in eggplant fruit is attributed to high polyphenol oxidase activity. The cultivars which are least susceptible to discoloration are considered suitable for processing purposes. Brinjal (*S. melongena* L.) of Solanaceae family is one of the widely used vegetable crop by most of the people and is popular in many countries viz., central, south and south east Asia, some part of Africa and central America (Grubben, 1977). It is an important vegetable due to its nutritive value, consisting of minerals like iron, phosphorus, calcium and vitamins like A, B and C. Unripe fruits are used primarily as vegetable in the country. It is also used as raw material in pickle making and dehydration industries (Singh *et al.*, 1992) and is an excellent remedy for those suffering from liver complaints. It is used in ayurvedic medicine for curing diabetes and also as a good appetizer. It is good aphrodisiac, cardiogenic, laxative, mutant and reliever of inflammation. In world, brinjal occupies an area of 1.128 million hectare with a production of 1.74 million tonnes with an average productivity of 15, 434 tonnes per hectare.

Som and Malty (1986) reported that the actual area under brinjal cultivation in India is not available due to its seasonal nature of cultivation. The present farming system totally depends on use of chemical fertilizers, pesticides and growth regulators for enhancing crop productivity which gradually culminated in a situation where there is a need to reconsider the alternative to chemical agriculture developed in the western world. It is a well documented fact that increased dependence on agrochemicals including fertilizers has led to several ill effects on the environment and human.

IMPORTANT DISEASE OF BRINJAL

Damping off (*Pythium spp.*, *Phytophthora spp.*, *Rhizoctonia spp.*, *Sclerotium spp.* and *Sclerotinia spp.*)

Symptoms: It is a serious disease of brinjal seedlings and mainly occurs in nursery bed. The disease infected seedlings rot at ground level and then the plants fall over ground. The seedlings die in patches. Both the pre-emergence and post-emergence damping-off symptoms are seen in diseased state. The germinating seeds are infected by fungi at the initial stages. The infection later spreads to hypocotyls basal stem and developing roots. The post-emergence damping off phase is characterized by infection of the young, juvenile tissues of the collar at the ground level. The affected seedlings become pale green and brownish lesions are found at the collar region, resulting in bottling and topple over of seedlings.

Management:

- Avoid over-watering
- Drench the beds with Captan or Thiram at 0.4% at 5-7 days after germination
- Fumigate the soil with Formalin (7%) by drenching 10-15 cm deep soil
- Give hot water treatment to seeds (52°C for 30 min)
- Treat the seeds with Captan or Thiram at 3 g kg⁻¹ seed
- The seed bed should be treated with Formalin before sowing of seeds
- The seeds should be treated without water (30 min at 52°C) or Cerasan or Agrosan G.N. before sowing of seed
- The seedlings in the nursery should be sprayed with any fungicides at regular intervals

Phomopsis blight and fruit rot (*Phomopsis vexans*)

Symptoms: Phomopsis blight is a serious fungal disease of brinjal which is caused by the fungi *Phomopsis vexans*. It affects mostly stems, leaves and fruits of brinjal. Serious infection stem symptoms of this fungal disease include brown or dark sunken lesions slightly above the soil surface and can result in cankers. Seedlings eventually collapse and die. The pathogen attacks leaves but older ones are more susceptible. Lesions are epically circular, gray to brown and develop a light center. In the center of older lesions, numerous fruiting bodies, called pycnidia, can be observed as small, black pimples, embedded in the host tissue. Affected leaves may turn yellow and drop prematurely. Spots and cankers can form on mature stems and branches. The most important symptoms are on the fruit. Fruit injury begins as a pale, sunken, oval area(s) on the surface. These subsequently enlarge and become depressed. With one lesion or several spots coalescing, large portions of the fruit are affected.

Management:

- Use of disease free seeds, seeds treatment with some fungicide and long crop rotation are the most common remedial measures of this disease
- Disease resistant variety (Such as Pusa Bhairab, Pusa Cluster etc.) should be cultivated
- The disease can effectively be controlled by weekly spraying of nursery and field with Zineb (Dithane-Z-78) or Mancozeb (Dithane M-45) at 2.5 g L⁻¹ of water
- Prompt destruction of infected plant material to reduce initial inoculums
- Plant pathogen-free seed and/or resistant varieties
- Transplants should be Phomopsis-free

- About 3-4 year crop rotation is beneficial, since the fungus does not infect other crops
- Weed control is advisable since pathogen can survive on solanaceous weeds such as nightshades
- Fungicides may be warranted and should be done in combination with the above cultural practices

Little leaf of brinjal

Symptoms: This is a serious viral disease of brinjal. The disease is transmitted by leaf hopper (*Cestius* (*Hishimonus*) *phycitis* and *Amrasca biguttula biguttula*). The leaves of the infected plants in the early stages are light yellow in colour. The leaves show a reduction in size and are malformed. Disease affected plant are generally shorter in stature bearing a large number of branches, roots and leaves than healthy plants. The petioles get shorter considerably, many buds appear in the axil of leaves and internodes get shortened thus giving the plants a bushy appearance. Flower parts are deformed leading the plants to be sterile. Infected plants do not bear any fruit. However, if any fruit is formed it becomes hard and tough and fails to mature.

Management:

- Adopting sanitary measures including the eradication of susceptible volunteer crop plants from a previous planting can reduce the damage
- Use of barriers of trap crops and early removal and destruction of infected plants is also recommended. The sowing time can be adjusted to avoid the main flights of the beet leafhopper
- Spraying Malathion (2 m L of water) starting with the appearance of the leaf hoppers controls their population. The disease affected plants should be destroyed
- The insect vector should be controlled by spraying the crop with Dimethoate (Rogor-30 EC or Oxidemeton methyl (Metasystox-25 EG) disease
- Disease resistant variety such as Pusa purple cluster should be cultivated

Bacterial wilt (*Pseudomonas solanacearum*)

Symptoms: The characteristic symptoms include wilting of the foliage followed by collapse of the entire plant. The wilting is characterized by dropping and slight yellowing of leaves and vascular discoloration. Drying of plants at the time of flowering and fruiting are also characteristic to the disease condition. The infected cut stems pieces when dipped in water, a white milky stream of bacterial oozes coming out which is the diagnostic symptom for bacterial wilt.

Management:

- Follow crop rotation
- Rogue out the infected plants and destroy them
- Raise nursery in disease free beds
- Soil fumigation with Formalin at 7% before sowing
- Seed treatment with Streptomycin (150 ppm) for 90 min

Leaf spot (*Cercospora melongenae*)

Symptoms: The disease symptoms are characterized by chlorotic lesion, angular to irregular in shape, later turning grayish-brown. Severely infected leaves drop off prematurely, resulting in reduced fruit yield. The disease causes characteristic leaf spots with concentric rings. The spots are mostly irregular and coalesce to cover large areas of the leaf blade. Severely affected leaves drop off. The symptoms on the affected fruits are in the form of large deep-seated spots. The infected fruits turn yellow and drop off prematurely.

Management:

- Removal and destruction of affected plant parts and spraying the affected plants with Bavistin (0.1%) or Chlorothalonil (2 g L⁻¹ of water) is useful for disease control
- Rogue out the infected plants and destroy them

Mosaic

Symptoms: This is a viral disease caused by *Potato virus Y* and transmitted by aphids (*Aphis gossypii* and *Myzus persicae*). The important symptoms of the disease are mosaic mottling of the leaves and stunting of plants. The leaves of infected plants are deformed, small and leathery. Plants show a stunted growth when infected in the early stages. Leaves of affected plants exhibit mottling with raised dark green areas. Blisters are formed on the leaves and size of leaves reduced. The virus is transmitted through seeds and by aphids.

Management:

- Collect the seeds from virus free plants
- Disease incidence can be minimised by reducing the population of aphids, removal and destruction of infected plants and eradication of susceptible weed hosts
- In the nursery, aphids can be controlled by application of Carbofuran (1 kg a.i./ha) in the nursery bed at the time of sowing seeds

- Followed by 2-3 foliar sprays of Phosphamidon (0.05%) at an interval of 10 days
- Spraying Phosphamidon (0.05%) at 10 days interval starting from 15-20 days after transplanting effectively controls the aphids

Fusarium

Symptoms: Symptoms first appear as a slight yellowing of foliage and wilting of upper leaves. As wilting progresses, leaves may turn dull-green to brown and remain attached to the plant. When the stem and roots are cut diagonally, reddish-brown streaks are visible in the vascular tissues. In Fusarium wilt, the underground stems become dry and brown as a result of cortical decay while roots may have soft and water soaked appearance. Stunted growth, withering of immature fruits, yellowing of lower leaves, drooping of the apical portion, browning of vascular bundles and ultimate drying of the whole plant. Wilting of seedlings is also a common characteristic of the diseases.

Management:

- Plant on raised beds to promote soil water drainage away from roots. Thoroughly disinfect equipment before moving from infested to clean fields
- Follow long term crop rotation with non solanaceous crop
- Grow resistant varieties

Late blight

Symptoms: Newly infected leaves have dark-green water soaked small lesions (spots) and as the lesions grow, they appear as brown spots, with each spot surrounded by a yellow green margin. A closer look at the leaf margin will show where the fungus is most active and how it spreads on the leaf tissues. There is a halo (ring) of white spore producing structures that is found in the margin of the advancing lesion on the underside of the leaf. As the infection spreads, more brown spots appear causing the whole plants to blacken and die. A plant that is severely infected by late blight has a distinctive odor as a result of the rapid breakdown of the leaf tissues.

Management:

- If possible buy a brinjal variety that is resistant to the disease. However, there is no brinjal variety that is resistant to late blight
- Plant only diseased-free seed and tubers
- Practice proper field sanitation. Properly remove culled Brinjal and destroy all volunteer Brinjal plants

Alternaria leaf spot (*Alternaria melongenae*, *A. solani*)

Symptoms: Causes characteristic spot on the leaf with concentric rings. Affected leaves may drop off. It may also infect fruits that turn yellow and may drop off prematurely. Symptoms of early blight occur on fruit, stem and foliage of Brinjal and stem, foliage initial symptoms on leaves appear as small 1-2 mm black or brown lesions. Under conducive environmental conditions, the lesions enlarge and are often surrounded by a yellow halo. This so-called Bullseye type lesion is highly characteristic of early blight. As lesions expand and new lesions develop, entire leaves may turn chlorotic and dehisce, leading to significant defoliation.

Management:

- Early blight control is based on crop rotation, removal and destruction of crop debris from previous crops, staking, mulching and timely application of fungicides
- Application of fungicides is also generally needed for early blight control. Field tests have shown that chlorothalonil, maneb and mancozeb fungicides all available at gardening supply stores under a variety of trade names provide effective early blight control when used according to label directions and applications are started early in the season

Fruit rot (*Phytophthora nicotianae*)

Symptoms: High humidity favours the development of the disease. The symptoms first appear as small water soaked lesions on the fruit which later enlarges in size considerably. Skin of infected fruit turns brown and develops white cottony growth.

Management:

- Removal and destruction of the affected fruits and spraying the crop with Difolatan (0.3%) thrice at an interval of 10 days effectively controls the disease

Verticillium wilt (*Verticillium dahliae*)

Symptoms: The disease attacks the young plants as well as mature plants. The infected young plants show dwarfing and stunting due to the shortening of the internodes. Such plants do not give flower and fruit. Infection after the flowering stage results in development of distorted floral buds and fruits. The affected fruits finally drop off. The infected leaves show the presence of irregularly scattered necrotic pale yellow spots over the leaf lamina. Later on, these spots coalesce resulting in

complete wilting of the leaves. The roots of the affected plants are split open longitudinally, a characteristic dark brown discoloration if the xylem vessels is observed.

Management:

- Crop rotation with bhendi, tomato, potato should be avoided
- Soil application and foliar Application with Benlate (0.1%) is effective in reducing the wilt disease

Collar rot (*Sclerotium rolfsii*)

Symptoms: The disease occasionally occurs in serious form. The lower portion of the stem is affected from the soil borne inoculums (sclerotia). Decortication is the main symptom. Exposure and necrosis of underlying tissues may lead to collapse of the plant. Near the ground surface on the stem may be seen the mycelia and sclerotia. Lack of plant vigour, accumulation of water around the stem and mechanical injuries help in development of this disease.

Management:

- Seed treatment with 4 g of Trichoderma viride formulation per kilogram seed will help in reducing the disease
- Spraying with Mancozeb at 2 g L⁻¹ of water
- Collection and destruction of diseased parts and portions of the plant

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