



Report of Bacterial Diseases of Tomato from Marathwada Region of Maharashtra, India

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Abstract

Tomato (*Lycopersicon esculentum* Mill.) is one of the most popular vegetables in the world. Tomato is grown in all the states of India. Tomato production is sensitive to temperature. It is good source of vitamins C and A. Tomatoes suffer through number of diseases caused by fungi, Bacteria, viruses etc. Three bacterial diseases of tomato were recorded from Marathwada region of Maharashtra (India) viz. Bacterial spot (caused by *Xanthomonas campestris* pv. *vesicatoria*), bacterial speck (caused by *Pseudomonas syringae* pv. *tomato*) and bacterial canker (*Clavibacter michiganensis* subsp. *michiganensis*). Symptoms of bacterial spot were recorded as small, brown, water soaked, circular spots surrounded with yellowish halo on leaves and as the disease advances green fruits also get affected. Bacterial speck shows symptoms like burning of leaf margins, stunted growth and in severe infection death of seedlings was also recorded. Bacterial canker disease chiefly affect the fruits to show water soaked spots with a white halo which later turn in dark brown, corky and cankerous. All these bacterial diseases of tomato were recorded from all the districts of Marathwada region.

Keywords: Tomato, bacterial disease, *Lycopersicon esculentum*, Marathwada region.

Introduction

Tomato (*Lycopersicon esculentum* Mill.) belongs to family Solanaceae, is one of the most popular and widely grown vegetable around the world. It is chiefly grown in the countries viz. Peru, South America, Spain, Morocco, Mexico, Turkey, India, Italy etc. Tomato is grown in all the states of India. In India, around 7500 varieties of tomato are grown and with the help of modern irrigation technology, the crop can grow all year round. To meet the need of urban population, it is grown more intensively in suburbs of large cities and this has resulted in endemic development of many of its diseases¹. Tomato production is sensitive to temperature; the optimal temperature required for the luxuriant growth of tomato is 23-27°C. Temperature below 15°C and above 35°C during the day time and above 21°C during the night is detrimental to fruit setting. It prefers sandy soils but can be grown on heavy or clay soils. Tomato is nutritionally very important crop, which is good source of vitamin C and A. It also contains the carotene lycopene, one of the most powerful natural antioxidants. Lycopene is helpful to improve the skin's ability to protect against harmful UV rays.

A satisfactory crop of top-grade tomatoes can be obtained only from well-nourished plants that are free from disease¹⁰. Tomato crop is prone to various types of diseases such as seed borne, soil borne as well as air borne. Hence, it suffers through large number of severe diseases caused by fungi, bacteria, viruses, mycoplasma, nematode etc. Large number of workers has reported fungal diseases of tomato²⁻⁷. Important diseases caused

by fungi are: early blight (*Alternaria solani*), late blight (*Phytophthora infestans*), southern stem blight (*Sclerotium rolfsii*), septoria leaf spot (*Septoria lycopersici*), fusarium wilt (*Fusarium oxysporum* f. sp. *lycopersici*), damping off (*Pythium aphanidermatum*), gray mold (*Botrytis cinerea*), leaf mold (*Fulvia fulva*), buck eye rot (*Phytophthora parasitica*), powdery mildew (*Leveillula taurica*).

Many bacterial diseases of tomato have been reported by research workers⁷⁻¹⁴. Well known bacterial diseases of tomato are: wilting of leaves and whole plant (*Pseudomonas corrugata*, *P. solanacearum*), bacterial spot (*Xanthomonas campestris* pv. *vesicatoria*), bacterial canker (*Clavibacter michiganensis* sub sp. *michiganensis*), brown discoloration of vascular system and production of adventitious roots (*P. solanacearum*, *P. corrugata*), pith necrosis (*P. corrugata*), stem necrosis (*P. marginalis*, *P. viridiflava*) and bacterial speck (*Pseudomonas syringae* pv. *tomato*).

Viral diseases also play an important role in the destruction of tomato crop. Many research workers^{5, 6, 15} reported various viral diseases viz. tomato mosaic (TMV), alfalfa mosaic (AMV), tomato leaf curl (TLCV), tomato spotted wilt (TSWV or *Tospovirus*), tomato bunch top virus (TBTV). Nematodes cause root knot disease (caused by *Meloidogyne incognita*) of tomato, in which rounded galls were recorded on roots as the disease advances it may result in stunting or wilting of the plants^{7, 16}.

Some of the noninfectious disorders were observed in tomato plants. Blossom-end rot is a disorder of tomato fruit that usually

occurs after rapidly growing plants endure a prolonged dry spell or after a period of unusually abundant rainfall. Heavy application of nitrogen fertilizer also tends to promote blossom end rot¹⁶. Herbicide injury is usually caused by drift, when the wind blows the herbicide away from the target area. Catfacing can be recognized by the malformed tomato fruit, it occurs due to exposure of flower buds to cold. Physiological leaf roll is temporary condition caused by weather conditions or by an inconsistent supply of moisture. Sunscald occurs when tomatoes are exposed to the direct rays of the sun during hot weather. Growth cracks were encouraged due to drought followed by heavy rain or watering. Poor fruit set occurs for several reasons viz. extreme temperature, dry soil, shading, excessive nitrogen etc.

Hence, the survey has been carried out for the incidence of bacterial diseases of tomato in Marathwada region of Maharashtra (India).

Material and Methods

Diseased tomato (Leaves, twigs, fruits etc) samples were collected from various districts of Marathwada region (Aurangabad, Beed, Osmanabad, Latur, Nanded, Hingoli, Parbhani and Jalna) and brought to the laboratory for further investigation. The infected samples were washed with running tap water and isolation of bacterial pathogen was done as per the following method:

Isolation of bacteria: The small infected portion of the leaf spot along with the healthy parts was cut with a sterile blade. The leaf pieces were then placed in sterile cavity blocks and cut to ooze the bacterial pathogen in the sterile distilled water. Twenty ml of the Nutrient Agar (NA) medium at 45°C was poured and solidified in petridishes (9 cm size). The bacteria were streaked out with a sterile wire loop on to the NA plate. Laminar flow was used for the purpose of isolation. After 48 hrs of incubation at 30±2°C; the developed colonies were transferred to NA slants. In order to obtain bacteria from rotted fruits, they were squeezed together with the fingers to press out the bacteria containing sap, which was later streaked on NA plates.

Confirmation of the Pathogen: After incubation, colonies of bacteria were developed, which were then transformed on NA slants for pure culture. The pathogenicity of the isolates was confirmed by adopting Koch's postulates¹⁷.

Results and Discussion

Bacterial spot of tomato: The disease was recorded to cause by *Xanthomonas campestris* pv. *vesicatoria*. Symptoms of bacterial spot disease were recorded on leaf as small, brown, water soaked, circular spots surrounded with yellowish halo. Later on these water-soaked regions enlarges and color changes from dark green to purplish-gray, accompanied by a distinctive black center. The leaf spots increases with the time and coalesced with

each other to show the burning appearance. At several places of the study area defoliation was recorded due to Large number of spots on leaves. As the disease advances, green fruits also get affected. Diseased fruits initially appears as a black stippling, eventually causing lesions with distinct margins, these small spots are superficial and do not rupture the skin. The main economic effect of the diseases is the reduction in number, weight and quality of fruit.

Bacterial Speck of tomato: The disease was recorded to cause by *Pseudomonas syringae* pv. *tomato*. It was a seed borne disease and the pathogen was also isolated from infected tomato plant debris. The pathogen remains for longer period in the plant debris, but when it get associated with the healthy plant, bacteria may multiply at the base of leaf hairs and healthy tomato leaves get infected. The disease prefers low temperature (12⁰C - 25⁰C) with high relative humidity. Bacterial speck showed symptoms like burning of leaf margins, stunted growth and in severe infection death of seedlings was also recorded. Initially, small or tiny dark brown spots surrounded by yellow halo appeared on leaves. On the basis of symptoms alone, it was difficult to tell the difference between the bacterial spot and bacterial speck disease.

Bacterial Canker of tomato: Bacterial canker disease, caused by *Clavibacter michiganensis* subsp. *michiganensis*, affects leaves, stem and fruits of the plants. The disease was characterized by browning of the margins of leaves. The affected leaves turn brown and die progressively from the margins towards the midrib. Generally, only one side of the leaf gets affected. Canker bacteria sometimes survive for several weeks in minute yellowish tan to rust-colored inconspicuous lesions on the surface of stems and leaves, without causing systemic infection. Stem showed cavities later may develop into splitting open into brown, longitudinal cankers. Bacterial canker disease chiefly affects the fruits to show water soaked spots with a white halo, which later turn into dark brown, corky and cankerous elevated portion. Spots on fruit were quite distinctive, white and slightly raised at first, then raised, dark-colored centers with white halos 3-5 mm in diameter. The white halo turned brown as the spot becomes older. Severely infected fruit showed extensive internal breakdown, with yellow or brownish cavities, especially near the stem end.

Callis *et al.*,¹⁸ studied molecular identification of bacterial canker and bacterial wilt diseases in tomatoes. He analyzed gram positive bacterial colonies with *Clavibacter michiganensis* subsp. *michiganensis* specific primers Cmm5 and Cmm6 in PCR assays of which 3 produced 614 bp amplification products and were identified as *C. michiganensis* subsp. *michiganensis*. The study demonstrated the reliable detection methods of bacterial canker disease in tomatoes and possible resistance sources to bacterial canker disease from wild tomato accessions. Improved sample preparation for PCR-based assays in the detection of *Xanthomonads* causing bacterial leaf spot of tomato were explained by Mbega *et al.*,¹⁹ and concluded that both FTA

plant card and WPS can be used for PCR detection of BLS causing *Xanthomonads* in tomato. However, the FTA plant card was recommended as it produced clearer PCR products than WPS. WPS was recommended for experiments requiring isolation of live bacterial cells on NA media. Jarvis and MacKen,¹⁶ described 37 diseases of tomato caused by fungi, Bacteria, viruses, mycoplasma, nematodes etc in his book. Zeitoun and Koipsel,¹³ concluded that bacterial speck, a leaf spot of tomato can be a serious problem on tomato seedlings.

Conclusion

Bacterial spot (*Xanthomonas campestris* pv. *vesicatoria*), bacterial speck (*Pseudomonas syringae* pv. *tomato*) and bacterial canker (*Clavibacter michiganensis* subsp. *michiganensis*) were recorded from all the districts of Marathwada region. Symptoms of bacterial spot were recorded as small, brown, water soaked, circular spots surrounded with yellowish halo on leaves and as the disease advances green fruits also get affected. Bacterial speck shows symptoms like burning of leaf margins, stunted growth and in severe infection death of seedlings was also recorded. Bacterial canker disease chiefly affects the fruits to show water soaked spots with a white halo which later turn in dark brown, corky and cankerous.

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