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Research Article

Status of Bacterial Blight Disease on Pomegranate in Andhra Pradesh

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ABSTRACT

India occupies first position in the world in pomegranate area (0.125 million ha) and production (1.140 million tonnes). The leading pomegranate growing states of India are Maharashtra (70.2%), Karnataka (10%), Gujarat (7.4%), Andhra Pradesh (6.7%), Telangana (1.9%), Madhya Pradesh (1.9%), Tamil Nadu (1.0%) and Rajasthan (0.4%). In Andhra Pradesh, the major pomegranate growing areas are Ananthapuram district, Kurnool, Kadapa and parts of Chittoor. A survey was conducted on disease incidence of bacterial blight of pomegranate caused by Xanthomonas axonopodis pv.punicae during the year 2015.During the survey, it was observed that mean disease incidence of bacterial blight on fruit was more than disease incidence on leaves in all the areas surveyed. Within Andhra Pradesh state, the mean disease incidence on leaves and fruits was highest in Kurnool district (24.04 % on leaves and 31.72% on fruit) followed by Kadapa district (22.15 % on leaves and 28.15% on fruit) and was found to be least in Ananthapuram district (12.89 % on leaves and 21.58% on fruit) The mean disease incidence in these three districts ranged from 6.4% to 36.6% on leaves and 8.8 % to 50.2 % on fruits.

Key words: *Pomegranate, bacterial blight, disease incidence, Xanthomonas axonopodis pv. Punicae.*

INTRODUCTION

Among the major pomegranate growing countries, India, Iran, China, the USA, and Turkey are the five major producers of pomegranate. However, exact data on its area and production in the world is not available due to the rapid increase in production and expansion. The current total annual world production of pomegranate fruit is estimated to be around 1.5 million tonnes[7].

India occupies first position in the world in pomegranate area (0.125 million ha) and production (1.140 million tonnes). But, Spain ranks first position in productivity with 18.5 t/ha followed by USA (18.3 t/ha). The leading pomegranate growing states of India are Maharashtra (70.2%), Karnataka (10%), Gujarat (7.4%), Andhra Pradesh (6.7%), Telangana (1.9%), Madhya Pradesh (1.9%), Tamil Nadu (1.0%) and Rajasthan (0.4%)[8].

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Among the biotic constraints that threaten pomegranate cultivation bacterial blight of pomegranate caused by *Xanthomonas axonopodis p*v. *punicae* is a wide spread disease causing economic losses of 50-100 per cent depending upon disease severity. It assumed epidemic form and occurs in all pomegranate growing states resulting in abandoning of crop by the farmers. Information on disease incidence and losses caused by the disease in Karnataka and Maharastra states are available. In AP, Subramanyam[15] recorded 71.0 and 62.5 per cent disease Part of PhD thesis work submitted to ANGRAU, Guntur severity on leaves and fruits, respectively. As much reports on incidence and prevalence of the disease in AP is not available, the present study was undertaken to observe disease incidence at major pomegranate growing districts of AP.

MATERIAL AND METHODS

Survey for the disease incidence

Roving survey was carried out during Kharif 2015 to 2018 in different orchards of major pomegranate growing districts, i.e., Ananthapuram, Kurnool and Kadapa of Andhra Pradesh. The diseased plants were identified based on typical symptoms of bacterial blight on leaves, stem and fruits. During early stages of disease, water soaked, oily lesions were observed which became corky, dark coloured spots at later stages of infection. The disease incidence on leaves and fruits were recorded in every orchard using the formula.

$$\frac{\text{No. of plants affected}}{\text{Total no. of plants}} \times 100$$

Collection of disease specimen: The diseased plant parts *viz*. leaves and fruits were collected separately from the individual orchard, labelled and brought to the laboratory for the further isolation of bacterial pathogen.

Isolation and purification of pathogen: The bacterial blight infected parts were washed in running tap water and the infected portion along with small portion of healthy tissue was cut into 5 mm bits. These bits were surface sterilized with 0.1 per cent (w/v) mercuric chloride solution and washed in three series of sterile distilled water to remove traces of mercuric chloride. The bits were then crushed in 2 to 3 ml of sterile distilled water and allowed to diffuse for 5 to 10 min at room temperature. A loopful of the crushed suspension was streaked on Nutrient Glucose agar (NGA) plates aseptically and incubated at 30^0 C for 3 to 5 days. Colonies grown after 48 hrs were picked out and again streaked on NGA plates and the discrete colonies were sub cultured on NGA slants for further studies.

Pathogenicity test: The pathogenicity of the forty seven bacterial isolates was proved on pomegranate seedlings cv. Bhagwa. Each isolate collected from different regions was separately multiplied in nutrient broth by inoculating a loopful of respective bacterial isolate. The inoculated flasks were incubated for three days at 30^0C. Eight months old pomegranate plants were sprayed with water and covered with a polythene sheet 24 hours before inoculation. The cell suspension of the bacterial isolates was adjusted to 5 X 10^6 cfu per ml and sprayed on the leaves with an atomizer. After inoculation, the plants were covered with polythene sheet and kept under humid conditions for the next 72 hours, then kept open and observed for appearance and development of symptoms. Plants sprayed with sterile distilled water served as a control. Upon symptom expression on artificially inoculated leaves, the pathogen was re-isolated and the culture was compared with the original culture.

RESULTS AND DISCUSSION

Within Andhra Pradesh state, the mean disease incidence on leaves and fruits was highest in Kurnool district (24.04 % on leaves and 31.72% on fruit) followed by Kadapa district (22.15 % on leaves and 28.15% on fruit) and was found to be least in Ananthapuram district

(12.89 % on leaves and 21.58% on fruit) The mean disease incidence in these three districts ranged from 6.4% to 36.6% on leaves and 8.8 % to 50.2 % on fruits (Table 1). In general, the mean disease incidence on fruit was more than disease incidence on leaves in all the areas surveyed.

From the data, it was observed that the disease was prevalent in all the districts in mild to severe form. The disease incidence on fruits was found to be higher than the disease incidence on leaves irrespective of location, variety and season. The variations in the disease incidence may be due to variation in the fruit bearing seasons and also may be because of variable environmental conditions that may or may not favour the bacterial growth and its spread under constant inoculum availability.

These views are supported by Ashish and Arora[1] who reported that the disease remains prevalent in mild to moderate form throughout the year at higher temperature ranged between 20.0-43.0^{0}C during April-July and become severe under highly humid conditions (>80 %) and moderate temperature (25-35^{0}C) during rainy season.

Varied bacterial blight disease incidence from mandal to mandal, district to district and state to state was also reported by Subramanyam[15], Sharma *et al.*[14], Gouda *et al.*[4], Gamanghatti and Patil[3].

Isolation

Isolation of the causal organism was made from the infected plant parts showing typical symptoms of bacterial blight collected from different parts of AP and its adjoining states. Isolation was done by adapting streak plate method as explained in material and methods. Repeated isolation from the infected plant parts yielded well separated, circular, convex to slightly raised, light yellow to deep yellow, mucoid and small to medium sized colonies of bacterium on nutrient glucose agar (NGA) medium after 72 hours of incubation at 30^{0}C (Plate 1).

These findings are in conformity with the works of Hingorani and Mehta[5], Hingorani and Singh[6], Kanwar[10], Chand and Kishun[2] Manjula and Khan[11] and Jalaraddi[9].

Proving pathogenicity

Koch's postulates were followed to prove pathogenic nature of *X. axonopodis* pv. *punicae* isolates. For proving pathogenicity, the 48-72 hr old bacterial cell suspension (with OD value 0.4-0.6 at 600 nm) of each of the isolates collected from different regions was sprayed on to the susceptible pomegranate plants of Bhagwa variety as described in material and methods. The characteristics symptoms were observed on pomegranate leaves seven days after inoculation by all the isolates as small water soaked lesions. Later on, these spots turned into brown to black coloured lesions, which later developed into angular to irregular shaped spots along the margins, veins and veinlets of the leaf lamina in 15 days. Re isolations were carried out from these lesions for each isolate and comparisons were made with original culture to confirm the identity of the pathogen. The reisolated culture resembled the original mother culture (plate 2).

Similar studies on isolation and pathogenicity studies were also carried out by Kanwar[10]. *viz*., Hingorani and Mehta[5], Hingorani and Singh[6], Kanwar[10], Chand and Kishun[2] Manjula and Khan[11] and Jalaraddi[9], Yenjerappa[16], Raju[13] and Meena *et al.*[12] who reported that the artificially inoculated tender leaves showed infection in seven to ten days after inoculation. The growth of bacterial colonies isolated from infected leaves of pomegranate on agar plates was slow, with entire edges, glistening, colourless to pale yellow and browning of medium at high temperatures. Colonies on potato dextrose agar were round, raised, wet, shining, with entire edges, colourless to pale yellow and measured 1 to 2 mm in diameter.

From the present investigation, some information on disease scenario of pomegranate bacterial blight in Andhra Pradesh was generated. The disease incidence is gradually intensifying as evidenced from the new reports of disease within various states of India, but also in other states like Turkey, Pakistan etc. So, this information will help us to formulate the suitable management strategies to prevent spread and dissemination of the pathogen, further.

48 hr old bacterial suspension grown on nutrient glucose broth

Covering plants with polythene sheet one night before spraying bacterial suspension

Spraying bacterial suspension

Symptom expression as water soaked lesions from 7th DAI

Plate 2. Pathogenicity test

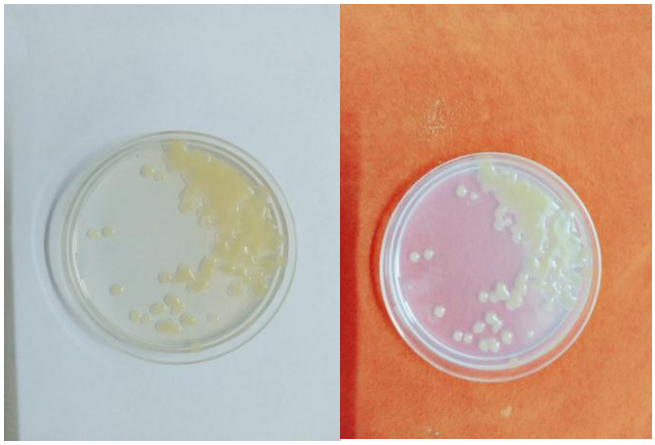

Plate 1. Purifed colonies of *Xanthomonas axonopodis* pv. *punicae* obtained by isolation from infected plant parts

Table: 1 Survey on bacterial blight disease incidence of pomegranate in major disctricts of AP

Sl. No.	State	District	Taluka	Village	No. orchards	Per cent disease incidence	
						Leaves	Fruits
1)		Ananthapuram		Peravali	1	14.0	26.0
2)				Venkatampalli	1	24.2	38.0
3)				Nayanapalli	1	26.2	42.0
4)				Korivipalli	1	28.4	50.2
5)				East Narsapuram	3	16.4	28.6
6)				Rotaripuram	2	8.0	14.2
7)				Korrapadu	2	24.6	38.4
					Mean	12.89	21.58
8)		Kadapa		Chintakunta	1	32.0	18.4
9)				TammiReddipalli	1	26.2	8.8
10)				Lakkalavaripalli	1	12.8	38.6
11)				Payasampalli	1	17.6	46.8
					Mean	22.15	28.15
12)		Kurnool	Krishnagiri	Koilakonda	3	36.6	58.2
13)			Krishnagiri	Krishnagiri	2	24.6	42.8
14)			Krishnagiri	Togarachedu	1	18.4	26.2
15)			Krishnagiri	Ramakrishnapuram	3	6.4	12.8
16)			Kalluru	Bastipadu	1	34.2	18.6
					Mean	24.04	31.72
					Mean of three districts	19.7	27.15

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