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Original Research Article

In vivo Evaluation of Some Antibiotics and Bioagents against *Xanthomonas axonopodis* pv. *punicae* causing Bacterial Blight of Pomegranate

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A B S T R A C T

A field trial was conducted to evaluate the efficacy of antibiotics Streptocycline, Bacterinol, at 250 and 500 ppm concentrations and two Bioagents against *X. axonopodis* pv. *punicae* a cause of bacterial blight of pomegranate. Antibiotic Bacterinol was found to be most effective with lowest PDI mean (9.21 %) at 500 ppm per cent. The Streptocycline recorded (9.68 %) at 500 ppm, followed by Streptocycline (10.74 %) and Bacterinol (11.75 %) at 250 ppm respectively. Mean Per cent Disease Control (PDC) with all the treatments ranged from 28.83 to 55.52 per cent. Both the concentrations streptoptocyclin showed highest mean disease control of 55.52 and 43.20 per cent. Bacterinol showed 47.03 and 35.20 per cent disease control at 500 and 250 ppm concentration, respectively. The bioagents *P. fluoroscens* and *B. subtilis* showed PDC 34.26 per cent and 28.83 per cent respectively.

Keywords

In vivo, *Xanthomonas axonopodis* pv. *punicae*, Bacterial blight, Pomegranate, Antibiotics and bioagents

Introduction

India is one of the largest producers of pomegranate in the world. During 2013-14, pomegranate was cultivated over 1.31 lakh ha with an annual production of 13.46 lakh tonnes and productivity of 10.27 tonnes/ ha. Bacterial blight of pomegranate was first reported in India from Delhi in 1952 (Hingorani and Mehta, 1952) and later from Karnataka in 1959 (Hingorani and Singh, 1959). The disease was of minor importance until 1991, when it appeared in epidemic proportion at IIHR experimental plot in Bangalore, resulting in 60-80 per cent yield losses (Chand and Kishun, 1991). Further the outbreak of disease was noticed in pomegranate growing area of Karnataka causing severe losses both in terms of yield and quality. In Maharashtra, the disease was first time reported in 2003 at Chickmahud village of Sangola Tahsil of Solapur district (Dhandhar *et al.*, 2004).

Now, it has become a serious problem in pomegranate orchards of Solapur, Sangli, Ahemadnagar, Nashik, Satara, Latur and Osmanabad districts. This disease spread like wild fire in pomegranate plantation, resulting drastic reduction in fruit yield. Today this disease is a bottle neck in production in all major states growing pomegranate (Kale *et al.*, 2011). In order to evaluate antibiotics and bioagents against

bacterial blight of pomegranate, the present studies were planned and conducted during 2016-17 on the VNMKV, Parbhani farm.

Materials and Methods

The antibiotics Streptocycline and Bacterinol, at concentrations of 250 and 500 ppm and two Bioagents were evaluated *in vivo* against *X. axonopodis* pv. *punicae.*

Design: RBD
Replications: Three
Treatments: Seven

Total two sprays of all the treatments were undertaken at an interval of 15 days, starting first spraying at first incidence of disease. One replication was maintained as unsprayed control without receiving any chemicals.

Observation on leaf bacterial blight disease were recorded and after each spraying and last observation on leaf bacterial blight was recorded at 15 days after last spraying. Five trees per treatment per replication were selected randomly and tagged. Trifoliate leaves (bottom, middle and top) from main branch on each observation and per cent leaf bacterial blight disease was recorded as per the scale mentioned in sampling methodology.

Based on numerical rating / scale observed, per cent disease index / intensity were worked out applying the formula given by Mc- kinney (1923).

$$PDI = \frac{\text{Summation of numerical rating}}{\text{No. of leaves /plant observed x Maximum rating}} \times 100$$

Further per cent disease control (PDC) was worked out by formula.

$$PDC = \frac{\text{PDI in control plot} - \text{PDI in treatment plot}}{\text{PDI in control plot}} \times 100$$

Results and Discussion

Effect of antibiotics and biocontrol agents on bacterial blight intensity

Result presented in (Table 1 and Fig. 1) indicated that the bacterial blight disease intensity observed at first appearance was ranged from 9.77 to 14.07 per cent. However, after first spraying per cent disease intensity was found to be decreased over first appearance in all the treatments. Disease intensity was recorded after first spraying was ranged from 9.27 to 12.30 per cent, irrespective of treatments as against 15.98 per cent in control (unsprayed). After second spraying, the disease intensity was found to be decreased significantly compared to that observed after first spraying.

After second spraying, the disease intensity was found to be reduced significantly over respective control (unsprayed) and first spraying. It was ranged from 9.27 to 11.48 per cent irrespective of treatment as 18.36 in control (unsprayed). However, Streptocycline recorded minimum disease intensity (9.27%) followed by Bacterinol (11.48 %) at 250 ppm. However Streptocycline recorded minimum disease intensity (5.70 %) followed by Bacterinol (7.89 %) at 500 ppm concentration respectively. Among the bioagents *Pseudomonas fluoroscens* recorded minimum disease intensity (9.89 %) followed by *Bacillus subtilis* (11.20 %) used as against (11.36 %) in control.

Thus, from the mean per cent disease intensity (PDI) data (Table 1 and Fig. 1) it was found that all the treatments

significantly and gradually reduced the bacterial blight intensity after first and second spraying over unsprayed *i.e.* control and over first appearance. However, antibiotics Bacterinol was found to be most effective with lowest PDI mean (9.21 %) at 500 ppm. per cent. The second control recorded was Streptocycline (9.68 %) at 500 ppm, followed by Streptocycline (10.74 %) and Bacterinol (11.75 %) at 250 ppm respectively. However among the bioagents *Pseudomonas fluoroscens* was found to be most effective with PDI mean (11.50 %) followed by *Bacillus subtilis* (11.79 %).

Effect of antibiotics on per cent disease control of bacterial blight

Per cent disease control (PDC) achieved after two spraying in all treatments over respective unsprayed *i.e.* control is presented in (Table 1). Similar trend as that of per cent disease intensity was observed. After first and second spraying significantly maximum disease control achieved from 21.77 to 41.98 per cent and 35.26 to 69.05 per cent, respectively. However, maximum disease control was achieved with antibiotic Streptocycline 41.98 and 69.05 per cent after first and second spraying, followed by Bacterinol 36.98 to 57.07 per cent at 500 ppm concentration respectively, whereas maximum disease control was achieved with Streptocycline 32.10 to 54.29 per cent followed by Bacterinol 27.28 to 93.11 per cent at 250 ppm concentration. Among the bioagents maximum disease control was achieved with *P. fluoroscens*21.77 to 46.75 per cent followed by *B. subtilis* 22.39 to 35.26 per cent respectively.

Table.1 Effect of different antibiotics and bioagents on the intensity of Bacterial blight of pomegranate

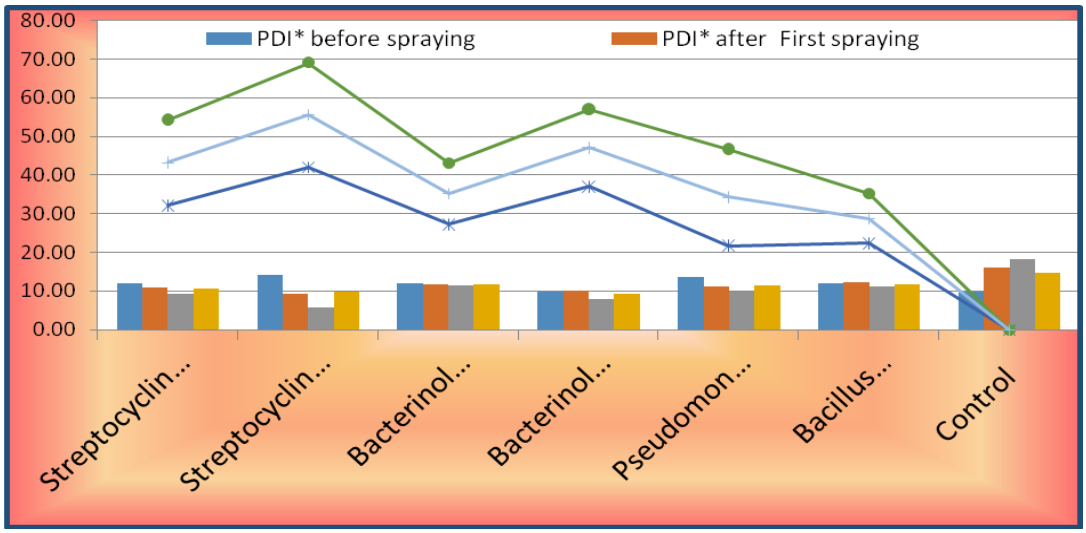
Tr. No.	Treatments	Conc.	PDI* before spraying	PDI* after spraying		Mean PDI	PDC* after spraying		Mean PDC
				First	Second		First	Second	
T_1	Streptocycline	250 ppm	11.97 **(20.24)**	11.00 **(19.36)**	9.27 **(17.72)**	10.74	32.10 **(34.51)**	54.29 **(47.46)**	43.20
T_2	Streptocycline	500 ppm	14.07 **(22.03)**	9.27 **(17.72)**	5.70 **(13.81)**	9.68	41.98 **(40.38)**	69.05 **(56.19)**	55.52
T_3	Bacterinol	250 ppm	12.07 **(20.32)**	11.70 **(20.00)**	11.48 **(19.80)**	11.75	27.28 **(31.48)**	43.11 **(41.03)**	35.20
T_4	Bacterinol	500 ppm	9.67 **(18.11)**	10.07 **(18.07)**	7.89 **(16.31)**	9.21	36.98 **(37.45)**	57.07 **(49.06)**	47.03
T_5	*Pseudomonas fluoroscens*	0.2 %	13.49 **(21.54)**	11.13 **(19.48)**	9.89 **(18.32)**	11.50	21.77 **(27.81)**	46.75 **(43.13)**	34.26
T_6	*Bacillus subtilis*	0.2 %	11.88 **(20.16)**	12.30 **(20.53)**	11.20 **(19.55)**	11.79	22.39 **(28.24)**	35.26 **(36.42)**	28.83
T_7	Control		9.77	15.98	18.36	14.70			00.00
	SE±		**1.23**	**0.4**	**0.3**		**0.8**	**0.59**	
	C.D. (P=0.05)		**3.73**	**1.24**	**1.02**		**2.60**	**1.83**	

*Average of three replications.
Figures in parenthesis are arcsine values.

Treatment Details

Treatments	Chemical name	Trade name	Concentration
T_1	Streptomycin sulphate	Streptocycline	250 ppm
T_2	Streptomycin sulphate	Streptocycline	500 ppm
T_3	2-bromo-2-nitropropane-1,3-diol	Bactrinashak	250 ppm
T_4	2-bromo-2-nitropropane-1,3-diol	Bactrinashak	500 ppm
T_5	*P. fluoroscens*	-	0.2%
T_6	*B.subtilis*	-	0.2%
T_7	Control		

Fig.1 *In vivo* efficacy of different antibiotics and bioagents on bacterial blight of pomegranate



Mean Per cent Disease Control (PDC) achieved with all the treatments (Table 1 and Fig. 1) ranged from 28.83 to 55.52 per cent. However, highest mean disease control of 55.52 per cent was recorded with antibiotic Streptocycline at 500 ppm concentration followed by Bacterinol 47.03 per cent, followed by Streptocycline 43.20 per cent, Bacterinol 35.20 per cent at 250 ppm concentration. These as followed by *P.fluoroscens*34.26 per cent and *B.subtilis* 28.83 per cent respectively.

Jadhav *et al.*, (2009) revealed that sprays with Streptocycline (500 ppm) + Copper oxychloride (2000 ppm) were found very effective in reducing the mean incidence (25.5%) of bacterial blight of pomegranate which was followed by Bronopol (500 ppm) + Copper oxychloride (2000 ppm) (33%), when compared with control (78.5%). Ashish *et al.*, (2016) studied the efficacy of Agro-chemicals on severity of bacterial blight of pomegranate. Three sprays of the agro-chemicals were given at 15 days interval starting from end June to end July on Mridula variety of pomegranate. Among the various treatments, Blitox (0.3%) + Streptocycline (250 ppm) proved most effective in reducing per cent disease index, per cent fruit cracking and providing maximum disease control. Quality parameters viz., TSS, acidity, weight, pulp colour, juice weight etc. were also studied. Maximum TSS, fruit weight, juice weight, pulp weight, 100 grain weight and total grain weight were observed in Blitox (0.3%) + Streptocycline (250 ppm) followed by Kocide (0.25%) + streptocycline (250 ppm) sprayed fruits.

Result obtained in respect of the efficacy of antibiotics and bio agents in effectively controlling the bacterial blight disease of pomegranate correlated with those reported earlier Kishun and Sohi (1984), Gupta (1991), Chandra (1994), Kalika(1996), Lodha (2001), Kaur and Thind (2002), Ravikumar (2009), Raut (2010), Sharma *et al.,* (2010), Lokesh (2015).

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