

## Original Research Article

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## Artificial Inoculation of Bacterial Leaf Blight (BLB) Pathogen/ Inoculum on Different Entries of Cotton Crop under South Gujarat Region, India

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### ABSTRACT

#### Keywords

Cotton, Bacterial blight, Screening, Entries, Artificial inoculation

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Cotton is a very important commercial crop of India and to the world. Essentially used for fibre, fuel and edible oil and various other purposes. It is important because it is cash crop to the farmers. Out of 30 diseases known to occur in cotton crop from time to time, the bacterial blight is the most wide spread and destructive disease reported to cause yield losses of about 10 to 30 per cent. In this experiment different cultivars/ entries were screened against the bacterial leaf blight disease. Infester row of susceptible check LRA 5166 was grown alternating every four rows of the test entries. The maximum PDI of LRA 5166 was 20.0 PDI was observed. Artificial inoculation was made twice by preparing the spore suspension of BLB. Total 44 entries were screened through artificial inoculation, from these entries *viz.*, GN Cot. 22, GISV 272, GSHV 180 and G. Cot.20 (LC) were moderately resistant against the bacterial leaf blight disease whereas, in case of Alternaria leaf spot disease, three entries *viz.*, GISV 272, GSHV 180 and G. Cot. 20 (LC) were observed as resistant against the disease. Rests of the entries were free from the infection.

### Introduction

Cotton plays an important role in sustaining the Indian economy as India is the world's second largest cotton producer (Khadi *et al.*, 2009). According to Agrios (2005), the estimated 36.5% average of total losses includes 14.1 % caused by diseases (fungi, bacteria and viruses), 10.2% by insects and 12.2% by weeds. Largest crop loss (14.1 %) is by phytopathogens alone. Among the phytopathogens, over 30 species of fungi can cause cotton plant infections (Farrell and

Johnson, 2005). The pathogen attacks host plants during all growth stages, infecting stems, leaves, bracts and bolls and causes seedling blight, black arm, angular leaf spot, and boll lesions (Verma, 1986). Symptoms show that lesions turn black as the age and increase in size. The affected leaves will have a torn appearance and premature defoliation occurs. Systemic infections follow the main veins of the leaf and appear as black streaks. Lesions associated with Bacterial Blight are generally darker in colour (Photograph 1). Yield losses due to bacterial blight range

between 1 % and 27 % depending on the cultivar and crop age (Mishra and Ashok Krishna 2001). Under natural bacterial blight infection, boll yield losses up to 35 % have been reported (Sheo Raj and Verma 1988). Bacterial blight disease caused by *Xanthomonas campestris* pv. *malvacearum* (Smith) Dye, [which is the same as *X. axonopodis* pv. *malvacearum* (Smith) (Vauterin *et al.*, 2000)] can be a serious disease in most Upland cotton (*Gossypium hirsutum* L.) growing areas of the world. Yield losses of 10 to 30 % (Thaxton and El-Zik, 2001). Bacterial blight disease (BLB) of cotton affects the entire aerial parts of cotton plant *i.e.* necrosis of parenchymatous tissue in the local phase and blockage of xylem vessels in its systemic phase (Casson *et al.*, 1977 and Sandipan *et al.*, 2015). Control has been achieved through the use of resistant cultivars and/ or cultural methods, including acid-delinting seed, sanitary practices during ginning and processing, applying fungicides to seed and the destruction of diseased plant residues following tillage (Thaxton and El-Zik, 2001). The purpose of the experiments was to determine the bacterial leaf blight reaction of cotton cultivars. Information may focus about their blight responses may be useful for further studies in incorporating blight resistance into future cotton cultivars/ entries.

### Materials and Methods

The susceptible cultivar LRA – 5166 were sown after each four entry in this experiment by dibbling method with the following experimental details (Table 1). All the recommended agronomic practices were followed for raising the good crop. In each plot of each treatment randomly tag 5 plants and score 5 lower and 5 middle leaves of each plant in terms of 0-4 grade and work out PDI as mentioned below by using 0-4 scale as given by Sheoraj, 1988 and then these grades

were converted into per cent disease incidence (PDI) by using the formula given by Wheeler, 1969 (Bacterial leaf blight and Alternaria leaf spot disease).

$$\text{Disease incidence (\%)} = \frac{\text{No. of infected plants}}{\text{No. of leaves observed} \times \text{Max. Grade}} \times 100$$

### Collection of the samples

Samples of naturally infected with bacterial leaf blight of cotton plants were collected from Research farm from the Main Cotton Research Station (MCRS), Surat during *Kharif*, 2016. The infected leaf part of the diseased samples were carefully placed in polythene bags, properly tagged and brought to the laboratory. Samples were thoroughly washed with sterile distilled water. The proper/ appropriate amount of infected leave was collected for the spore suspension to prepare. The diseased bits (Infected cotton leaves) were given a cut with sharp sterilized blade. The bits were left for one minute to allow bacterial ooze to come out in water and adjusted around to  $10^7$  colony forming units (cfu)/ ml. Approximately 15-20 days after inoculation, individual plants were graded for their disease reactions using the above formula.

### Results and Discussion

The entries found disease free and resistant during previous year were tested this year under natural field and artificial condition against the different diseases. Infester row of susceptible check LRA 5166 was grown alternating every four rows of the test entries. The maximum PDI of LRA 5166 was 20.0 PDI was observed. Artificial inoculation was made twice by preparing the spore suspension of BLB. Total 44 entries were screened through artificial inoculation (Table 2), from these entries *viz.*, GN Cot. 22, GISV 272,

GSHV 180 and G. Cot.20 (LC) were moderately resistant against the bacterial leaf blight disease (Table 3) whereas, in case of *Alternaria* leaf spot disease, three entries *viz.*,

GISV 272, GSHV 180 and G. Cot. 20 (LC) were observed as resistant against the disease (Table 4). Rests of the entries are free from the infection.

### Photograph.1



**For, Bacterial leaf blight (BLB) disease**

Score	Description
0	Immune, completely free from bacterial blight
1	Highly resistant, infection 0-10 %
2	Moderately resistant, infection 11-20 %
3	Moderately susceptible, infection 21-40 %
4	Highly susceptible, infection more than 40 %

**For, *Alternaria* leaf spot (ALS) disease**

Score	Description
0	No infection
1	Few <2mm, scattered, brown spots, < 5 % leaf area
2	Spots bigger, 3 mm, not coalescing, brown and 6-20 % leaf area covered
3	Spots 3-5 mm, irregular in shape-coalescing, 21-40% leaf area covered
4	Spots coalescing to form bigger lesions, irregular->40 % leaf area

**Table.1**

Location/ Zone	Variety/ Entry	Rep.	Plot size (mtr)	Spacing (cm)	Sowing Date	Fertilizer NPK kg/ha	Irrigation
SG II Surat (Gujarat)	44 + 01 SC (LRA 5166)	02	1.2 x 3.6 (Single row)	120 x 45	04.07.16	240:40:00	As and when required

**Table.2** Entries for confirmation and maintenance of disease resistant lines at MCRS, NAU, Surat (2016-17)

Sr. No.	Name of Entry Code/Decode		Bacterial leaf blight			Alternaria leaf spot		
			Field reaction	Artificial reaction	Reaction	Field reaction	Artificial reaction	Reaction
<b>Pr. Br. 02 (a) IET of <i>G. hirsutum</i> -Irrigated</b>								
1	GSHH 2729		0.0	0.0	DF	0.0	0.0	DF
2	GSHV 162		0.0	0.0	DF	0.0	0.0	DF
3	GN Cot. 22		0.0	5.5	MR	0.0	0.0	DF
<b>Pr. Br. 03 (a) PVT of <i>G. hirsutum</i>-Irrigated</b>								
4	GSHV 172		0.0	0.0	DF	0.0	0.0	DF
5	GSHV 173		0.0	0.0	DF	0.0	0.0	DF
<b>Pr. Br. 06 (b) Compact genotype</b>								
6	GISV 272		0.0	2.5	MR	0.0	3.0	R
7	GSHV 180		0.0	10.0	MR	0.0	2.5	R
8	G.Cot.20, LC		0.0	3.0	MR	0.0	2.0	R
<b>Pr. Br. 22 a/b IET- <i>G. arboreum</i></b>								
9	881	PA 793	0.0	0.0	DF	0.0	0.0	DF
10	882	ZC (AKA 7)	0.0	0.0	DF	0.0	0.0	DF
11	883	PAIG 77	0.0	0.0	DF	0.0	0.0	DF
12	884	PA 781	0.0	0.0	DF	0.0	0.0	DF
13	885	PAIG 326	0.0	0.0	DF	0.0	0.0	DF
14	886	PA 827	0.0	0.0	DF	0.0	0.0	DF
15	887	PAIG 373	0.0	0.0	DF	0.0	0.0	DF
16	888	PAIG 368	0.0	0.0	DF	0.0	0.0	DF
17	889	PA 255	0.0	0.0	DF	0.0	0.0	DF
18	890	PA 778	0.0	0.0	DF	0.0	0.0	DF
19	891	PA 363	0.0	0.0	DF	0.0	0.0	DF
20	892	PA 760	0.0	0.0	DF	0.0	0.0	DF
21	893	PA 788	0.0	0.0	DF	0.0	0.0	DF
22	894	PA 08	0.0	0.0	DF	0.0	0.0	DF
23	895	G. Cot. 19 (LC)	0.0	0.0	DF	0.0	0.0	DF
24	896	PA 796	0.0	0.0	DF	0.0	0.0	DF
25	897	PA 808	0.0	0.0	DF	0.0	0.0	DF
26	898	PA 741	0.0	0.0	DF	0.0	0.0	DF
<b>Pr. Br. 32 b IET of <i>G. herbaceum</i></b>								
27	951	RAHS 804	0.0	0.0	DF	0.0	0.0	DF
28	952	GShv 367/12	0.0	0.0	DF	0.0	0.0	DF
29	953	GShv 371/12	0.0	0.0	DF	0.0	0.0	DF
30	954	RAHS 801	0.0	0.0	DF	0.0	0.0	DF
31	955	GBhv 304	0.0	0.0	DF	0.0	0.0	DF
32	956	GBhv 307	0.0	0.0	DF	0.0	0.0	DF
33	957	ANGh 1601	0.0	0.0	DF	0.0	0.0	DF
34	958	GShv 362/12	0.0	0.0	DF	0.0	0.0	DF
35	959	GN Cot. 25 (LC)	0.0	0.0	DF	0.0	0.0	DF
36	960	DWDh 1602	0.0	0.0	DF	0.0	0.0	DF
37	961	RAHS 802	0.0	0.0	DF	0.0	0.0	DF
38	962	ANGh 1602	0.0	0.0	DF	0.0	0.0	DF
39	963	RAHS 803	0.0	0.0	DF	0.0	0.0	DF
40	964	GShv 385/12	0.0	0.0	DF	0.0	0.0	DF
41	965	ZC (G.Cot.23)	0.0	0.0	DF	0.0	0.0	DF
42	966	GBhv 302	0.0	0.0	DF	0.0	0.0	DF
43	967	DWDh 1601	0.0	0.0	DF	0.0	0.0	DF
44	968	GBhv 305	0.0	0.0	DF	0.0	0.0	DF
<b>LRA 5166 (SC)</b>			20.0	3	MS	0.0	0.0	DF

**Table.3** Reaction against the Bacterial leaf blight disease at MCRS, NAU, Surat (2016-17)

Sr. No.	Grade	Reaction	Total/ Number of entry	No. of entries
1	0	Disease free	Rest of all entries	40
2	1	Resistant	-	0
3	2	Moderate resistant	GN Cot. 22, GISV 272, GSHV 180, G.Cot.20, LC	4
4	3	Moderate susceptible	-	0

**Table.4** Reaction against the Alternaria leaf spot disease at MCRS, NAU, Surat (2016-17)

Sr. No.	Grade	Reaction	Total/ Number of entry	No. of entries
1	0	Disease free	Rest of all entries	41
2	1	Resistant	GISV 272, GSHV 180, G.Cot.20, LC	3
3	2	Moderate resistant	-	0
4	3	Moderate susceptible	-	0

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