The Bioscan 10(4): 1641-1644, 2015
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

ROLE OF ENVIRONMENTAL FACTORS ON THE BACTERIAL BLIGHT (BLB) DISEASE OF COTTON CAUSED BY XANTHOMONAS CAMPESTRIS PV. MALVACEARUM UNDER SOUTH GUJARAT CONDITION

PRASHANT, B. SANDIPAN*, H. R. DESAI AND B. G. SOLANKI
Main Cotton Research Station (MCRS),
Navsari Agricultural Universit^{y} (NAU), Surat - 395 007 (Gujarat), INDIA
e-mail: prashantsandipan@gmail.com

KEYWORDS
Bacterial leaf
Blight
Epidemiological studies
Xanthomonas

Received on :
15.07.2015

Accepted on :
18.11.2015

***Corresponding author**

ABSTRACT
Bacterial blight disease was recorded with its first appearance and subsequently at weekly interval till it prevailed on G. Cot. Hy. 12 variety. Result shows that disease was first appeared in 36th Met. week (First week of September) with 1.37 % intensity and prevailed up to 48thMet. Week*i.e.*last week of November (1.75 %) with its peak during 42nd week *i.e.* 2nd week of October (24.50 %) for the year 2012-13. And for 2013-14, indicates that the disease was first appeared in 32nd standard week (First week of August) with 2.66% intensity and prevailed up to 47thMet. Week *i.e* third week of November (1.37%) with its peak during 38th week *i.e.*September 3rd week (24.75 %) and then it gradually decreased. Bacterial leaf blight has positive correlation with the environmental factors

INTRODUCTION

Bacterial leaf bight (BLB) of cotton caused by *Xanthomonas campestris* pv. *malvacearum* (Smith) Dye (synonyms *Xanthomonas malvacearum* (E. F. Sm) Dowson) is one of the most important and serious disease of cotton and other crops including fruit crops (Raghuwanshi *et al*., 2013), prevalent in cotton growing areas of the world. And this commercial crop is the back bone of national economy of our country. Cotton remains the most miraculous fiber under the sun, even after 8,000 years. No other fiber comes close to duplicating all of the desirable characteristics combined in cotton. The fiber of a thousand faces and almost as many uses, cotton is noted for its versatility, appearance, performance and above all, its natural comfort. From all types of apparel, including astronauts' in-flight space suits, to sheets and towels, and tarpaulins and tents, cotton in today's fast-moving world is still nature's wonder fiber. It provides thousands of useful products and supports millions of jobs as it moves from field to fabric (www.cotton.org). The cotton production is influenced by the repeated out breaks of pest and diseases and these are the major factors responsible for lower yield of cotton in India. Out of 25 diseases known to occur in cotton crop from time to time, the bacterial leaf blight is the most wide spread and destructive disease reported to cause yield losses of about 10 to 30 per cent (Bhatti and Bhutta, 1983, Kalpana *et al*., 2004) and also affect the quality of lint (Sharma and Chauhan, 1985). And it may go cause yield losses of up to 10% - 50% have been recordedin other cotton growing regions and such loses on annual basis are dependent on severity of epidemic, cottonspecies susceptibility and environmental factors Darlington, 2001 and Nahunnara *et al*., 2007. Bacterial leaf blight, boll rots, wilts and leaf spots are the most destructive cotton diseases (Chopra, 1977). Under natural condition, bacterial blight infection, boll yield losses up to 35 % have been reported (Sheo Raj and Verma, 1988). Leaf spots rank third among the diseases on cotton in India. Among the leaf spots, bacterial blight (*Xanthomonas campestris* pv. *malvacearum* (Smith), *Alternaria* leaf spot (*Alternaria macrospora* Zimn) and grey mildew (*Ramulariaaereola*) have been reported for the damage. It 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). Resistant varieties are the valid option in any disease management strategies. Control of the disease through chemicals, seed treatment or acid delinting is recommended but bactericide alone or in combination with fungicides dose not eradicate the pathogen completely (Khan and Ilyas, 1999, Hussain and Tahir, 1993). Characterization of environment factors conductive for bacterial blight disease may provide a basis to forecast the disease and issue advance warning to cotton growers for its timely management. Keeping in view the seriousness of this disease, a study was conducted to know the effect of environment factors on the bacterial blight (BLB) disease development.

MATERIALS AND METHODS

The susceptible cultivar LRA - 5166 were sown around the G.Cot.Hy. 12. In this experiment, dibbling method was adopted with the following experimental details. All the recommended agronomic practices were followed for raising the good crop. The observations on disease development were recorded at weekly interval from 20 randomly selected tagged plants and 5 leaves from lower part and 5 leaves from middle/ plant were selected by using 0-4 scale as used by Sandipan *et al.*, 2015and it is given by (Sheoraj, 1989).

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

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 %

It is the standard methodology as adopted by AICCIP (All India Co-ordinated Cotton Improvement Project).The weather data of the corresponding disease interval was obtained from the meteorological observatory of MCRS, Surat. The data were compiled to standard weeks and subjected to correlation equations (Gomez and Gomez, 1984).

Sr. No.	Experimental details	Description
1	Location/Zone	SG II Surat (Gujarat)
2	Treatment	1 (Single)
3	Variety	G.Cot.Hy. 12
4	Design	Single block
5	Rep.	Non Replicated
6	Plot size in ha	0.05 ha
7	Spacing (cm)	120x45
8	Sowing Date	07/07/12 & 18/06/13
9	Fertilizer NPK kg/ha	240.40.0
10	Irrigation	2 (Two)

RESULTS AND DISCUSSION

Bacterial blight disease was recorded with its first appearance and subsequently at weekly interval till it prevailed on G. Cot. Hy. 12 variety. The result presented in Table: 1 and Graph: 1 indicated that the disease was first appeared in 36th Met. week (First week of September) with 1.37 % intensity and prevailed up to 48th Met. Week *i.e.* last week of November (1.75 %) with its peak during 42nd week *i.e.* 2nd week of October (24.50 %).The correlation of incidence bacterial blight disease (BLB) with the weather parameters revealed positive and significant correlation with all the weather parameters except minimum temperature for the year 2012-13.

However for the year 2013-14, the disease was first appeared in 32nd standard week (First week of August) with 2.66% intensity and prevailed up to 47th Met. Week *i.e* third week of November (1.37%) with its peak during 38th week *i.e.*September 3rd week (24.75 %) and then it gradually decreased (Table 2 and Graph 2).

The correlation of bacterial blight disease (BLB) incidence with the weather parameters revealed positive and significant correlation with the minimum temperature. All other parameters

Table 1: Occurrence of Bacterial blight on G. Cot. Hy. 12 in relation to different weather parameters at MCRS, NAU, Surat (2012-13)

Sr.No	STD Met Week	Period	BLB PDI	Weather parameter Temp Max	Min	Humidity Morning	Evening	Rainy days	Rain fall
1	29	16/07/2012	0.00	32.8	27.5	87.5	71.5	19.2	3
2	30	23/07/2012	0.00	31.8	27.3	92.2	86.0	2.6	1
3	31	30/07/2012	0.00	31.2	26.4	91.4	88.7	8.0	1
4	32	06/06/2012	0.00	31.9	23.0	83.8	76.2	66.0	3
5	33	13/08/2012	0.00	31.5	25.6	80.2	70.8	18.0	1
6	34	20/08/2012	0.00	32.0	25.6	75.1	76.5	29.4	5
7	35	27/08/2012	0.00	32.5	25.9	82.8	77.0	55.8	2
8	36	03/09/2012	1.37	31.1	25.6	92.8	87.4	218.2	6
9	37	10/09/2012	5.87	30.3	24.9	91.8	86.7	77.8	6
10	38	17/09/2012	10.75	32.0	25.6	82.0	61.2	0.0	0
11	39	24/09/2012	12.35	33.4	24.8	82.0	55.4	30.6	2
12	40	01/10/2012	16.00	34.6	25.2	84.7	63.5	13.6	3
13	41	08/10/2012	17.25	35.7	22.5	82.4	45.7	0.0	0
14	42	15/10/2012	24.50	36.0	21.4	70.6	33.9	0.0	0
15	43	22/10/2012	11.62	36.1	20.4	68.0	36.0	0.0	0
16	44	29/10/2012	10.50	34.8	18.8	58.0	37.3	0.0	0
17	45	05/11/2012	7.62	33.4	18.4	69.0	47.7	0.0	0
18	46	12/11/2012	3.75	32.7	18.2	77.4	41.3	0.0	0
19	47	19/11/2012	2.87	33.9	16.7	69.0	23.7	0.0	0
20	48	26/11/2012	1.75	33.2	16.7	79.0	39.0	0.0	0
21	49	03/12/2012	0.00	34.2	21.0	67.0	32.0	0.0	0
22	50	10/12/2012	0.00	31.7	17.4	85.6	37.0	0.0	0
23	51	17/12/2012	0.00	32.7	20.6	62.8	30.6	0.0	0
24	52	24/12/2012	0.00	33.4	17.1	64.7	28.4	0.0	0
Correlation efficient				0.6935**	-0.4001*	0.6659**	0.8032**	0.5684**	0.7797**

*significant at 5 % and ** 1% level of significance

Table 2: Occurrence of Bacterial blight on G. Cot. Hy. 12 in relation to weather parameters at MCRS, NAU, Surat (2013-14)

Sr.No	STD Met Week	Period	BLB PDI	Weather parameter Temp Max	Min	Humidity Morning	Evening	Rainy days	Rain fall
1	30	23/07/13-29/07/13	0.00	29.2	27.3	88.5	81.7	7	86.9
2	31	30/07/13-05/08/13	0.00	28.0	26.6	90.3	82.9	7	196.4
3	32	06/08/13-12/08/13	2.66	30.2	27.7	89.6	79.9	4	31
4	33	13/08/13-19/08/13	4.50	30.7	27.1	88.9	80	7	57
5	34	20/08/13-26/08/13	6.75	30.2	27.2	86.7	77.3	3	25.6
6	35	27/08/13-02/09/13	7.37	31.6	27.2	83.3	69.1	2	2.2
7	36	03/09/13-09/09/13	13.12	32.3	27.1	85.7	77.7	3	12.6
8	37	10/09/13-16/09/13	20.12	34.2	26.7	88.6	63.3	3	27
9	38	17/09/13-23/09/13	24.75	33.1	26.9	85.7	73.9	3	62.1
10	39	24/09/13-30/09/13	12.37	29.2	26.7	91.8	90.6	5	385.4
11	40	01/10/13-07/10/13	8.62	32.1	27.4	89.6	82.4	3	2.8
12	41	08/10/13-14/10/13	7.10	32.1	26.3	91.0	83.1	2	21.4
13	42	15/10/13-21/10/13	6.50	36.2	25.6	86.3	51.3	0	0
14	43	22/10/13-28/10/13	5.62	35.3	24.9	69.8	35.0	0	0
15	44	29/10/13-04/11/13	5.37	34.9	22.1	76.4	37.4	0	0
16	45	05/11/13-11/11/13	3.65	32.2	22.7	83.7	36.7	0	0
17	46	12/11/13-18/11/13	2.25	32.2	22.1	74.8	38.0	0	0
18	47	19/11/13-25/11/13	1.37	33.6	19.8	67.7	37.1	0	0
19	48	26/11/13-02/12/13	0.00	34.5	24.2	66.7	52.0	0	0
20	49	03/12/13-09/12/13	0.00	33.2	20.2	76.8	52.0	0	0
21	50	10/12/13-16/12/13	0.00	31.8	17	71.0	28.8	0	0
22	51	17/12/13-23/12/13	0.00	30.8	17.3	80.0	35.2	0	0
Correlation efficient				0.203	0.491*	0.409	0.368	0.168	0.181

significant at 5 % and ** 1% level of significance

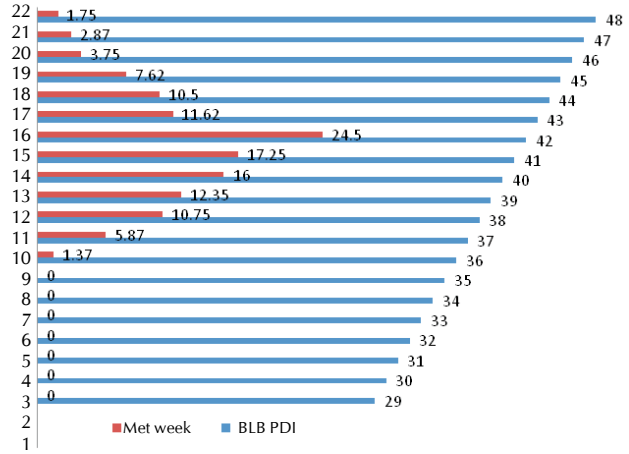

Figure 1: Seasonal incidence of bacterial blight disease in cotton during 2012-13

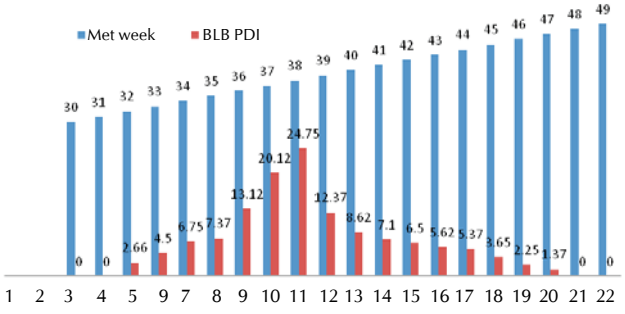

Figure 2: Seasonal incidence of bacterial blight disease in cotton during 2013-14

Figure 3: BLB infecting leaves of cotton crop

morning and evening humidity, maximum temperature, rainy days and rainfall) had positive but non- significant correlations. Similar findings also found by that free water is required for foliar infection and secondary spread is favored by high humidity following periods of wind and rain which distribute the bacteria within the crop canopy. Provided the relative humidity is 85%, the optimum temperature for disease development is around 36C (Hillocks, 1992 and Steve, 2004). Thaxton and El-Zik, 2001and Sandipan *et al*., 2015 found that high rainfall, relative humidity as well as warm temperature favours the disease development which in turn affect yield.Tuti *et al*., 2015 that environmental factors such as relative humidity and rainfall generally have been found to increase the incidence, rate of spread and severity of angular leaf spot diseases thereby reducing yield of cotton crop.

ACKNOWLEDGEMENT

Author thanks to Main Cotton Research Station (MCRS), Surat (Gujarat) for providing the required facility and other necessary arrangements for the facilitating the experiment.

REFERENCES

Bhatti, M. A. R. and Bhutta, A. R. 1983. Incidence of seed borne bacterial infection in different cultivars of cotton. *Pakistan cotton*. **27:** 73-74.

Casson, E. T., Richardson, P. E., Brinkerhoff, L. A. and Gholson, R. K 1977. Histopathology of immune and susceptible cotton cultivars inoculated with *Xanthomonascampestris*pv. *malvacearum*. *Phytopathology*. **67:** 195-196.

Chopra, B. L. 1977. Important diseases of cotton and their control measures in India. *Paper presented at staff course on cotton production, its processing and marketing technology* held at P.A.U., Ludhiana.

Darlington, M. 2001. Improving Host Plant Resistance without Sacrificing Yield and Quality in Zimbabwe Cotton.Zimbabwe Cotton Research Report, the Cotton Research Institute (CRI), Ministry of Agriculture.

Gomez, K. A. and Gomez, A. A. 1984. *Statistical procedure for agricultural research*. 2nd Ed. J. Willey and Sons, New York. p. 680.

Hillocks, R. J. 1992. Bacterial Blight. In: Hillocks, R.J., Ed., Cotton Diseases, CAB International, Willingford. pp. 38-85.

https://www.cotton.org/pubs/cottoncounts/fieldtofabric/index.cfm

Hussain, T. and Tahir, M. 1993. Chemical control of bacterial blight of cotton. *Pak. J. Phytopathol*. **5(1-2):** 119-121.

Kalpana, P., Chellamuthu, V. and Jeyalakshmi, C. 2004. Screening of cotton hybrids against bacterial blight incited by *Xanthomonas campestris*pv. *malvacearum* (Smith) Dye, *Paper presented in Inter. Symp. Strat. Sust. Cotton Prod.* - A Global Vision 3, Crop Production, 23-25 November 2004, Univ. Agric. Sci., Dharwad (India), pp. 373-374.

Khan, M. A. and Ilyas, M. B. 1999. Cotton germplasm response ofslow blighting against *Xanthomonascampestris*pv.*malvacearum* and slow curling against CLCuV infection. Proc. 2nd.National Conf. of Pl. Path. Sep. 27-29, U.A.F. pp. 138-139.

Nahunnaro, H., Gwary, D. M. and Okunsanya, B. O. 2007. An Assessment of the Reaction of Ten Cotton Genotypes toAnguler Leaf Spot Disease under Field and Controlled Conditions in Northern Guinea Savanna of Northeast Nigeria. *J. Arid Agriculture*. **1:** 37-44.

Raghuwanshi, K. S., Hujare, B. A., Chimote, V. P. and Borkar, S. G. 2013. Characterization of *Xanthomonas axonopodis* pv. *punicae* isolates from western Maharashtra and their sensitivity of chemical treatments. *The Bioscan*. **8(3):** 845-850.

Sandipan, B., Prashant, Desai, H. R. and Solanki, B. G. 2015. Correlation of the environmental factors with the Bacterial blight disease of Cotton caused by *Xanthomonascampestris*pv. *malvacearum* under South Gujarat condition. *J. Plant Development Sciences*. **7(6):** 525-527.

Sharma, B. K. and Chauhan, M. S. 1985. Studies on the chemical control of foliar diseases of cotton in Haryana state. *Agric. Sci. Digest*. **5:** 153-56.

Sheo Raj and Verma, J. P. 1988. Diseases of cotton in India and their management.*Review of Tropical Plant Pathology*. **5:** 207-254.

Steve, K. 2004. Bacterial blight (Angular Leaf Spot) of Cotton.Plant Pathology Extension, North Carolina StateUniversity. Cotton Disease Information Note, No. 3.

Thaxton, P. M. and El-Zik, K. M. 2001. Bacterial Blight. In: Kirk Patrick, T.L. and Rothrock, C.S., Eds., Compendiumof Cotton Diseases, 2nd Edition, American Phytopathological Society. pp. 34-35.

Tuti, N. Z., Nahunnaro, H. and Ayuba, K. 2015. Effect of some environmental factors on incidence and severity of Angular leaf spot of cotton in Yola and Mubi, Adamawa state, Nigeria. *World J. Engineering and Technology*. **3:** 19-25.