Screening of Varieties/ Breeding Materials for Resistance to Different Diseases in Natural Condition under South Gujarat Region, India

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A B S T R A C T

Cotton is one of the principal commercial crop and it is the back bone of national economy of our country. Cotton remains the most miraculous fiber and is still nature’s wonder fiber. Cotton is grown all around the globe, and is traded internationally as well. Higher production of cotton requires high investment in terms of fertilizers, pesticides, weedicides and other cultural operations. This ultimately sometimes leads to or influenced by the repeated out breaks of pest and diseases and occasionally responsible for lower yield of cotton. 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 (Bhatti and Bhutta, 1983, Kalpana et al., 2004, Sekhon et al., 2008 and Sandipan et al., 2016) and also affect the quality of lint

Keywords
Cotton, Screening, Bacterial leaf blight, Alternaria, Diseases, Resistance.

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Introduction

Cotton is a natural fibre as well as White Gold enriches with soft, fluffy staple fiber that grows in a boll, or protective case, around the seeds of the cotton plant. The fiber is almost pure cellulose. The plant is a shrub native to tropical and subtropical regions around the world, including the Americas, Africa, and India.

Cotton is a white fibrous agricultural product that has a wide variety of uses, from textile production, to creating paper, to producing oil and food products. Cotton is grown all around the globe, and is traded internationally as well. Higher production of cotton requires high investment in terms of fertilizers, pesticides, weedicides and other cultural operations. This ultimately sometimes leads to or influenced by the repeated out breaks of pest and diseases and occasionally responsible for lower yield of cotton. 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 (Bhatti and Bhutta, 1983, Kalpana et al., 2004, Sekhon et al., 2008 and Sandipan et al., 2016) and also affect the quality of lint.
Bacterial leaf blight, boll rots, wilts and leaf spots are the most destructive cotton diseases (Chopra, 1977). Under natural, 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 Zimm) and grey mildew (Ramularia aereola) have been reported to be damaging. Bacterial leaf blight (BLB) of cotton caused by Xanthomonas campestris pv. malvacearum (Smith) Dye 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). In north India, the cotton leaf curl virus disease (CLCuD) caused by a Gemini virus and transmitted by whitefly, Bemisia tabaci has become a major threat to cotton cultivation since its appearance in 1993 (Monga et al., 2011). Seed is the costliest input and is highly prone to losses in germination and vigour due to seed mycoflora. Seeds acts as carrier in transmission of pathogens and thereby causes economic threat to cotton cultivation. Resistant varieties are the valid option in any disease management strategies. Considering this whole scenario, this present investigation was made to ascertain the spectrum of fungal flora associated with the seeds of cotton.

**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 net 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 diseases). Here, in this experiment only grades were mentioned for BLB and ALS.

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

For Alternaria disease, it is standard methodology of AICCIP, Cotton and similar disease scale was used by Anil, G. H. in his thesis on Studies on leaf blight of Bt cotton.
caused by *Alternaria* spp. in 2013 submitted to the University of Agricultural Sciences, Dharward and Hosagoudar et al., 2008ab.

**For, wilt disease**

Count diseased plants out of total plants assessed and work out per cent disease incidence and decide disease reaction by referring grade chart.

\[
\text{PDI} = \frac{\text{No of diseased plants}}{\text{No of plant assessed}} \times 100
\]

For wilt disease, it is standard methodology of AICCIP, Cotton.

**Results and Discussion**

Efforts to locate resistant sources and their utilization in resistance breeding programme are imperative to manage the diseases in the long run. Screening was therefore undertaken to evaluate a number of cotton entries against the major diseases during *kharif* 2015.

Total 39+01 (LC) entries of cotton were evaluated for their reaction against wilt, alternaria leaf spot, bacterial blight diseases and other diseases. The results presented in table 2 indicated that of, these entries, twenty five entries were observed disease free whereas, six entries as resistant, six entries as moderately resistant and two entries *i.e.* GBHV-170 and GSHV-185 observed in the Grade 3 against the bacterial blight disease with 12.5 and 11.5 % PDI.

Whereas, for Alternaria leaf spot disease, twenty one entries as disease free, sixteen entries as resistant and two entries as moderately resistant against the disease. However, other diseases were not observed.

### Agro meteorological condition of MCRS, Surat

| Parameters       | June  | July | Aug  | Sept | Oct | Nov | Dec | Jan | Total  | Av. |
|------------------|-------|------|------|------|-----|-----|-----|-----|--------|-----|
| Surat Rainfall (mm) | 270.0 | 135.2 | 027.0 | 174.4 | -   | -   | -   | -   | 606.6  | -   |
| Rainy Days       | 7.0   | 9.0  | 4.0  | 5.0  | -   | -   | -   | -   | 25.0   | -   |
| Max. Temp.(°C)   | 33.5  | 32.5 | 32.0 | 32.0 | 36.4 | 34.9 | 32.8 | -   | 33.4   | -   |
| Min. Temp.(°C)   | 28.7  | 29.2 | 28.6 | 27.4 | 26.6 | 23.7 | 18.0 | -   | 26.0   | -   |
| Morning RH %     | 77.0  | 84.0 | 88.0 | 90.0 | 79.0 | 82.0 | 70.0 | -   | 81.4   | -   |
| Evening RH %     | 72.0  | 79.0 | 75.0 | 77.0 | 62.0 | 69.0 | 61.0 | -   | 70.7   | -   |
| Sunshine hrs.    | 4.7   | 3.7  | 3.0  | 6.1  | 6.7  | 5.8  | 7.3  | -   | 5.3    | -   |

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

| Score | Description                                                                 |
|-------|-----------------------------------------------------------------------------|
| 0     | DF= Immune, completely free from bacterial blight                            |
| 1     | R= Resistant, nearly 1 mm in diameter, not coalescing, reddish, not angular, veins free (Spots few scattered) |
| 2     | MR= Moderately resistant, leaf area covered up to 10 %                        |
| 3     | MS= Moderately susceptible, leaf area covered up to 11-20 %                  |
| 4     | S= Susceptible, leaf area covered more than 20 %                             |
For, alternaria leaf spot (ALS) disease

| Score | Description |
|-------|-------------|
| 0     | No infection, Completely free from the infection |
| 1     | Few <2mm, scattered, brown spots, leaf area covered < 5 |
| 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 covered |

For, wilt disease

| Score | Description |
|-------|-------------|
| 0     | I=No infection |
| 1     | R= Slight yellowing and no defoliation, < 5 % wilting |
| 2     | MR= Yellowing and browning of leaves, 6-15 % plants showing wilting |
| 3     | MS= Yellowing, browning and discolouration of leaves, Some leaves fall off. Of late partial wilting may occur, 16-25 % plants showing wilting |
| 4     | S= In early infection seedlings wilt, adult plant show yellowing, browning and dropping off of the leaves, >25 % plants showing wilting |

Table 1 Experiment details

| 1 | Details of the Experiment |
| 2 | Name of Trial : |
| 3 | Objective : To find out resistant sources for different diseases |
| 4 | Location : Main Cotton Research Station, Surat |
| 5 | Year of commencement : Kharif, 2015 |
| 6 | Experimental details |
| a | Design : Non replicated |
| b | Treatment /Variety : |
| c | Replication : |
| d | Plot size in mts : Gross: 1.2 x 3.6, Net: 1.2 x 2.7 |
| e | No. of varieties/treatment : 39 + 01 Local check |
| f | No. of rows/plot : Single row |
| g | No. of dibbles/row : 8 |
| h | Plot size in sq. meter : |
| i | Expt. area in ha. : 0.03 |
| j | Spacing : 120 x 45 |
| k | FYMCL/ha : |
| l | Fertilizer dose NPK kg/ha : 240:40:00 |
| m | Previous crop : |
| n | Date of sowing : 23.06.2015 |
| o | Date of germination : 27.06.2015 |
| p | Date of gap filling : 27.07.2015 |
| q | No. of plant protection : As & when required |
| r | No. of irrigation : As & when required |
| s | Date of harvesting : |
### Table 2
Reaction of cotton varieties/cultures against different diseases at MCRS, NAU, Surat during 2015-16

| Sr. No. | Entries  | Bacterial leaf blight | Alternaria leaf spot |
|---------|----------|-----------------------|----------------------|
|         |          | PDI | Max Grade | Reaction | PDI | Max Grade | Reaction |
| **MLT of G. hirsutum** |          |     |           |          |     |           |          |
| 1       | GISV-267 | 0.0 | 0         | DF       | 0.0 | 0         | DF       |
| 2       | GISV-272 | 0.0 | 0         | DF       | 0.0 | 0         | DF       |
| 3       | GSHV-159 | 0.0 | 0         | DF       | 0.0 | 0         | DF       |
| 4       | GSHV-162 | 0.0 | 0         | DF       | 0.0 | 0         | DF       |
| 5       | GJHV-514 | 0.0 | 0         | DF       | 0.0 | 0         | DF       |
| 6       | GJHV-516 | 6.5 | 2         | MR       | 0.0 | 0         | DF       |
| 7       | GBHV-170 | 12.5| 3         | MS       | 0.0 | 0         | DF       |
| 8       | GBHV-177 | 0.5 | 1         | R        | 2.5 | 1         | R        |
| 9       | GBHV-180 | 3.5 | 2         | MR       | 0.0 | 0         | DF       |
| 10      | GBHV-183 | 6.5 | 2         | MR       | 6.0 | 2         | MR       |
| 11      | GTHV-13/7| 5.0 | 2         | MR       | 6.5 | 2         | MR       |
| 12      | GTHV-13/32| 4.0| 2          | MR       | 3.0 | 1         | R        |
| **LSVT of G. hirsutum** |          |     |           |          |     |           |          |
| 13      | GISV-308 | 0.0 | 0         | DF       | 3.5 | 1         | R        |
| 14      | GSHV-182 | 0.0 | 0         | DF       | 4.0 | 1         | R        |
| 15      | GSHV-184 | 0.5 | 1         | R        | 3.0 | 1         | R        |
| 16      | GSHV-185 | 11.5| 3         | MS       | 2.5 | 1         | R        |
| 17      | GJHV-473 | 0.0 | 0         | DF       | 3.0 | 1         | R        |
| 18      | GJHV-477 | 0.0 | 0         | DF       | 2.0 | 1         | R        |
| 19      | GJHV-518 | 6.5 | 2         | MR       | 2.5 | 1         | R        |
| 20      | GJHV-523 | 0.5 | 1         | R        | 2.0 | 1         | R        |
| 21      | GJHV-533 | 0.0 | 0         | DF       | 0.0 | 0         | DF       |
| 22      | GBHV-184 | 0.0 | 0         | DF       | 0.0 | 0         | DF       |
| 23      | GTHV-13/28| 0.0| 0          | DF       | 0.0 | 0         | DF       |
| 24      | GBHV-185 | 0.5 | 1         | R        | 4.5 | 1         | R        |
| 25      | GBHV-187 | 0.5 | 1         | R        | 2.5 | 1         | R        |
| 26      | GBHV-193 | 0.0 | 0         | DF       | 0.0 | 0         | DF       |
| 27      | GTHV-7/70| 0.0 | 0         | DF       | 0.0 | 0         | DF       |
| 28      | GTHV-10/25| 0.0| 0         | DF       | 0.0 | 0         | DF       |
| 29      | GTHV-10/28| 0.5| 1         | R        | 2.0 | 1         | R        |
| 30      | GSHV-424/10| 0.0| 0         | DF       | 0.0 | 0         | DF       |
| 31      | GSHV-420/10| 0.0| 0         | DF       | 0.0 | 0         | DF       |
| 32      | GSHV-453/10| 0.0| 0         | DF       | 0.0 | 0         | DF       |
| 33      | GSHV-497/10| 0.0| 0         | DF       | 0.0 | 0         | DF       |
| 34      | GBHV-296 | 0.0 | 0         | DF       | 0.0 | 0         | DF       |
| 35      | GBHV-297 | 0.0 | 0         | DF       | 0.0 | 0         | DF       |
| 36      | GBHV-298 | 0.0 | 0         | DF       | 0.0 | 0         | DF       |
| 37      | GBHV-302 | 0.0 | 0         | DF       | 3.0 | 1         | R        |
| 38      | G. Cot. 23 (CC) | 0.0 | 0         | DF       | 2.0 | 1         | R        |
| 39      | G.N. Cot. 25 (CC) | 0.0 | 0         | DF       | 3.5 | 1         | R        |
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