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# RESISTANCE TO MIRID BUG *CREONTIADES BISERATENSE* (DISTANT) IN COTTON

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**ABSTRACT**

**A field experiment was carried out in the AICRP on Cotton, Haradanahalli Farm, Chamarajanagar, Karnataka to know the association of morphological characters of 15 cotton genotypes (different resistance category) influencing resistance to mirid bug, *Creontiades biseratense*. Cotton morphological parameters viz., trichome density on leaves, squares and midvein showed a significance difference with the genotypes and the higher incidence of mirid bug was recorded on genotypes having more trichome density. Similarly, genotypes having higher boll rind thickness and length of petiole recorded the higher incidence. of *C. biseratense.* There was a significant positive correlation between *C. biseratense* incidence and trichomes on leaves (r = 0.90**), trichomes on squares (r = 0.89**), trichomes on midvein (r = 0.91**), boll rind thickness (0.80**) and length of petiole (r = 0.60*). However thickness of leaf showed the non-significant negative difference among the genotypes (r = -0.03).**

**Key words:** Cotton, resistance, incidence, screening, *Creontiades biseratense*, trichome density, midvein, boll rind, thickness of leaf, squares, length of petiole, correlation coefficient

Cotton is one of the most commercially grown fibre crop in the world, plays a pivotal role in economic and social affairs of the world. In India cotton is most important cash crop accounting for 65 % (CCI, 2021) of the textile industry's fibre and handloom cloth quality has been widely praised in the market for its fineness and comfort. It occupies a significant position in the Indian national economy as it provides livelihood to millions of people so it is one of the major foreign exchange earners of the country. India has the world's largest cotton cultivation area, accounting for around 41% of global cotton area and providing 21% of total cotton production, increasing from 12.50 million hectares to 13.00 million hectares. (CCI, 2021). Thus, India ranks first in cotton area and production by cultivating in an area of 132.85 lakh hectares with a production of 352.48 lakh bales and productivity of 451 kg/ ha during 2020-21 (CCI, 2021). Among the many constraints in cotton production, insects are becoming a major one. About 1326 species of insect pests are known to attack the cotton crop across the world at different growth stages of the crop. In recent days sucking pests are causing severe menace in cotton ecosystem (Hanchinal et al., 2009; Meghana et al., 2018). In South India, the mirid bug, *Creontiades biseratense* (Distant) was newly recorded and creating a major problem in *Bt* cotton that leading to significant yield loss in cotton cultivation (Patil et al., 2006). Among sucking pests, the mirid bugs are observed to be the serious pest of Bt cotton (Sahu and Samal, 2020) and their survey on incidence in Bt cotton carried out in Karnataka with varied level of climatic factors (Vinayaka and Nandihalli, 2019). Hence, identification of mirid bug tolerant and high yielding genotypes need to be identified. To develop the resistant or tolerate cultivar against the pest, studying the host plant resistance mechanism is crucial. Therefore present investigation of morphological association of resistance against mirid bug was conducted during 2020-21.

## MATERIALS AND METHODS

To establish the resistance and susceptibility in relation to incidence of mirid bugs and major plant morphological characters in cotton, the observations on length of petiole, thickness of leaf and bolls, trichome density on leaves and square, density of trichome on midvein were made by adopting standard procedures by selecting 15 genotypes *viz.,* Br-24b-2676, Br-24b-2673, Br-24b-2675, Br-24b-2671, Br-2b-373, Br-2b-375, Br-24b-2678, CET H×B 20608, Br-2b-378, CET H×B 20609, CET H×B 20606, Br-13a-2663, CET H×B 20605, Br-2b-358 and Br-2b-359 representing different level of incidence at 60 DAS from screening trial of Kharif 2020.The observation on mirid bug was made from 10 squares/ plant from ten randomly selected plants. The mean data on the plant morphological characters were worked out and subjected for ANOVA (Gomez and Gomez, 1984; Hosmand, 1988) and means were separated by Tukey's HSD (Tukey, 1965) for interpretation. Categorization of genotypic resistance of genotypes was made by following the procedure outlined by Croxton and Cowden (1964). Length of petiole was measured by using scale and thickness of leaf lamina and boll bract was measured by vernier caliper. Observations were taken from three leaves and bolls/ plant. Trichome density was measured on leaf lamina and square. The number of hairs on lamina, midvein and square were counted from upper side of leaf and square visually with the help of compound microscope at 10x resolution. Observations were taken from three leaves and square/ plant and three plants from each replication. Further, to study the relationship between the mirid bug infestation and plant morphological characters, the mean data was subjected to multiple linear regression (MLR) analysis techniques by fitting different functions.

## RESULTS AND DISCUSSION

The trichome density of leaves among the different genotypes showed a significant difference. The susceptible and highly susceptible genotypes recorded the higher trichome density compared to moderately susceptible, moderately resistant and resistant genotypes. The lowest trichome density of 98.33, 99.33 and 100.33/ $cm^2$ was observed in Br-24b-2671(MR), Br-24b-2676(R), Br-24b-2678(MR) genotypes, respectively. These were on par with each other and showed a significant difference with other genotypes. This was followed by Br-24b-2673, Br-24b-2675, Br-2b-375 and Br-2b-373 which were on par with each other and reacted as moderately resistant and moderately susceptible. The highest trichome density was recorded in HS genotypes viz*.,* CET H×B 20605 (173.67/ $cm^2$), Br-2b-358 (172.33/ $cm^2$) and Br-2b-359 (163.67/ $cm^2$) which were on par with each other. This was followed by Br-2b-378, CET H×B 20609, CET H×B 20606 and Br-13a-2663. The genotypes viz*.,* Br-24b-2676(R) and Br-24b-2671(MR) recorded the lowest trichome density of 94 and 102/ $cm^2$ on squares, respectively. These two genotypes were on par with each other and recorded a significant difference with other genotypes. This was followed by Br-24b-2678 (109/$cm^2$), Br-24b-2673(119/ $cm^2$), which were on par with each other. Thus, resistant and moderately resistant group of genotypes showed lesser trichome density (Table 1).

Table 1. Incidence of mirid bug *C. biseratense* in relation to plant morphological characters (kharif 2020)

| S.No. | Genotypes | Resistance category | Mirids /10 squares/ plant | Trichome density/$cm^2$ on | | | Thickness (mm) | | Length of petiole (cm) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Leaves | Squares | Midvein | Leaf | Boll rind | |
| 1 | Br-24b-2676 | R | 1.43 | 99.33[a] | 94.00[a] | 102.66[a] | 0.33[ab] | 1.40[a] | 5.63[a] |
| 2 | Br-24b-2673 | MR | 2.10 | 113.67[ab] | 119.00[cde] | 116.00[abc] | 0.34[ab] | 1.45[a] | 6.03[abc] |
| 3 | Br-24b-2675 | MR | 2.20 | 122.00[bc] | 126.66[ef] | 122.66[bcd] | 0.34[ab] | 1.62[ab] | 7.17[abcd] |
| 4 | Br-24b-2671 | MR | 2.21 | 98.33[a] | 102.00[ab] | 107.00[ab] | 0.33[ab] | 1.54[ab] | 5.73[ab] |
| 5 | Br-2b-373 | MS | 2.73 | 129.33[bcd] | 113.33[cd] | 134.33[d] | 0.31[ab] | 1.74[ab] | 8.69[d] |
| 6 | Br-2b-375 | MS | 2.93 | 128.33[bcd] | 138.00[g] | 131.66[cd] | 0.29[ab] | 2.36[ab] | 8.50[d] |
| 7 | Br-24b-2678 | MS | 3.00 | 100.33[a] | 109.00[bc] | 108.00[ab] | 0.31[ab] | 1.57ab | 5.80[ab] |
| 8 | CET H x B 20608 | S | 3.80 | 135.33[cde] | 122.66[de] | 138.66[de] | 0.26[a] | 1.99[ab] | 9.23[d] |
| 9 | Br-2b-378 | S | 4.33 | 160.33[fg] | 152.66[hi] | 173.33[fg] | 0.31[ab] | 2.29[ab] | 8.20[cd] |
| 10 | CET H x B 20609 | S | 4.53 | 152.33[ef] | 144.33[gh] | 186.33[gh] | 0.34[ab] | 1.88[ab] | 8.53[d] |
| 11 | CET H x B 20606 | S | 4.60 | 147.33[def] | 142.33[g] | 153.33[e] | 0.25[a] | 2.10[ab] | 7.73[abcd] |
| 12 | Br-13a-2663 | HS | 5.00 | 144.00[def] | 134.66[fg] | 151.33[e] | 0.40[b] | 2.02[ab] | 8.07[bcd] |
| 13 | CET H x B 20605 | HS | 5.13 | 173.67[g] | 156.00[i] | 169.00[f] | 0.37[ab] | 2.53[b] | 8.47[d] |
| 14 | Br-2b-358 | HS | 5.50 | 172.33[g] | 168.33[j] | 186.33[gh] | 0.27[a] | 2.25[ab] | 8.73[d] |
| 15 | Br-2b-359 | HS | 6.21 | 163.67[fg] | 172.33[j] | 191.66[h] | 0.32[ab] | 2.31[ab] | 7.87[abcd] |
| | SE m ± | | - | 4.18 | 1.28 | 2.32 | 0.02 | 0.20 | 0.47 |
| | CD @ p=0.05 | | - | 12.12 | 3.73 | 6.72 | 0.08 | 0.58 | 1.37 |
| | Correlation coefficient | | | 0.90** | 0.89** | 0.91** | -0.30 | 0.80** | 0.60* |

Values followed by common letters non-significant at p=0.05 as per Tukey's HSD, (Tukey, 1956); R- resistant, MR- moderately resistant, MS- moderately susceptible, S- susceptible, HS- highly susceptible

While, the maximum trichome density on square was observed on Br-2b-359 (172.33) this was on par with Br-2b-358 (168.33) and recorded a significant difference with other genotypes. Similarly, the lesser trichome density on midvein was observed on resistant and moderately resistant group of genotypes and the trichome density was varied from 102.66 to 122.66/ $cm^2$. This was followed by moderately susceptible genotypes which were on par with each other and showed a significant difference with susceptible and highly susceptible genotypes. While, the higher trichome density of 191.66/ $cm^2$ was observed in Br-2b-359 (HR), followed by Br-2b-358 (168.33/ $cm^2$). The higher incidence of mirid bug was recorded on genotypes which have more trichome density on leaves, squares and midvein probably, this influenced the egg laying behaviour of mirid bug. Hence, these genotypes recorded more incidence of mirid bug compared to less resistant and moderately resistant group of genotypes which have less trichome. The thickness of leaf varied from 0.25-0.40 mm among all genotypes. The lowest thickness of 0.25, 0.26 and 0.27 mm was recorded in CET H×B 20609(S), CET H×B 20606 (S) and Br-2b-358 (HS), respectively. Likewise, higher thickness was recorded in Br-13a-2663(0.40 mm) and CET H×B 20605 (0.37 mm) which also recorded the higher incidence of mirid bug. There was no much influence of leaf thickness on incidence. Whereas boll rind thick have positive association with mired bug incidence because as thickness increases mired bug population also increases. It was evidenced in genotypes CET H×B 20605 (2.53 mm), Br-2b-375 (2.30) and Br-2b-358 (2.25 mm), which were recorded more incidence of mirid bug (Table 1). Length of petiole varied from 5.63-9.23 cm among different genotypes. The genotypes viz*.,* Br-24b-2676(R) and Br-24b-2671(MR) recorded the least petiole length of 5.63 and 5.73 cm respectively. While, the resistant and moderately resistant group of genotypes showed lesser length of petiole as compared with other group of genotypes (Table 1). The genotypes with more petiole length were found to be susceptible and length varied from 7.73-9.23 cm. Maximum petiole length was recorded on CET H×B 20608 (9.23 cm) and was on par with CET H×B 20609 (8.53 cm) and CET H×B 20605 (8.47 cm) where these genotypes recorded a higher incidence of mirid bug.

The correlation studies between mirid bug incidence and morphological parameters revealed a significant-positive association with morphological characters *viz.,* trichome on leaves (r=0.90**), trichomes on square (r=0.89**), trichomes on midvein (r=0.91**) and these results are probably due to influencing of egg laying behaviour of mirid bug. While, thickness of boll rind (r=0.80**) and length of petiole (r=0.60*) also showed the significant positive relation with mirid bug incidence (Table 1). Hence, lesser trichomes density and lesser boll rind thickness characters are the promising parameters highlighted from this study to use in resistance breeding. This might be due to fact that the bolls were the most preferred part by both nymphs and adults of mirid bug.

The association of morphological components with the incidence of mirid bug was in close conformity with the earlier findings of Bariola (1969) and Benedict et al. (1983). They reported that the polyphagous mirid pest of cotton *viz.,* tarnished plant bug, *Lygus lineoralis* and western tarnished plant bug *Lygus hespereus* expressed a positive association of trichome density for incidence of mirid bug, and this might be due to the preference of higher trichome density for egg laying. Likewise, Chikkarugi and Balikai (2011) observed trichomes on the lower leaf surface of genotypes that are resistant to shoot fly in sorghum. Prakash et al. (2013) also reported more mirid bug incidence on genotypes which have more trichome density. Hence, the hairy varieties like NCS-145, MRC-7351 and Tulsi-144 were more prone to mirid attack as compared to glabrous varieties like Brahma, VICH-303 and RCH-530. But the rind thickness and leaf thickness were not significantly correlated with the incidence of mirid bug. These are in contrast to the findings of Deb et al. (2015), Gonde et al. (2015), Amin et al. (2016) who reported that the higher trichome density hinders the insect movement and activity on plant. Present results corroborate those of Khan et al. (2014) and partially of Murugesan and Kavitha (2010) and Rizwan et al. (2021). Harishkumar (2015) reported the significant positive relation of mirid bug incidence with trichome density on lamina, midvein and leaf thickness. In contrast, number of hairs on leaf was negatively associated but positively associated with bract size as reported by Shalini (2010).

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## AUTHOR CONTRIBUTION STATEMENT

All authors equally contributed.

## CONFLICT OF INTEREST

No conflict of interest.

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