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Effect of trichome density against jassids resistance in cotton genotypes

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Abstract

The study was conducted for screening for 26 cotton genotypes for relative susceptibility/resistance against jassids laid out in All India Coordinated Cotton Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri, during *Kharif* season of the year 2020 and 2021. Among 26 genotypes 19 moderately resistant genotypes, 4 susceptible genotypes and 4 highly susceptible genotypes are recorded. The trichomes were compared against jassids incidence whereas higher trichomes are observed in resistant cotton genotypes than the susceptible cotton genotypes. Jassids infestation is more in susceptible genotypes than in resistant genotypes. In conclusion, trichomes confers a resistance against jassids incidence in cotton genotypes.

Keywords: Cotton, jassids, trichomes, resistance, susceptible

Introduction

Cotton is one of the economically and socially important cash crops in the world and a raw material for the textile industry. Cotton is an important fibre yielding crop hence called king of fibres or white gold. Commercial cotton is grown in 77 countries and 123 countries are involved in the cotton related activities. India is the second largest producer of cotton. The area, production and productivity of cotton during 2019 - 20 are 133.7 lakh hectares, 35.5 million tonnes and 451 kg per hectare respectively (Anonymous, 2020) [1].

Cotton is attacked by a large number of insect pests right from sowing till harvest. In India, the cotton ecosystem harbours about 162 species of insects which are known to devour cotton at various stages of growth, of which 15 are considered to be key pests. In the early stage, sucking pests like aphids, thrips, jassids and whiteflies and in the later stage, different kinds of bollworms cause reduction in yield and quality of cotton. Sucking pests have become quite serious from seedling stage to harvesting and their heavy infestation at times reduces the crop yield to a great extent. The estimated loss due to sucking pests is up to 21.20 per cent (Dhawan *et al.*, 1988) [6].

Leafhopper *A. biguttula biguttula* (Hemiptera: Cicadellidae), is a sap sucking insect pest which causes losses due to injection of toxins. The attacked leaves turn pale and then rust-red. With change in appearance, the leaves also turn downwards, dry up and fall to the ground. Owing to the loss of plant vitality, the cotton bolls also drop off, causing up to 35 per cent reduction in yield (Atwal and Dhaliwal, 2010) [3].

The trichomes interfere with the movement of insects and other small arthropods over the plant surface and make it more difficult for insects to access the leaf epidermis underneath for feeding (Southwood, 1986) [10]. Trichomes are often composed of cellulose and other substances that constitute low nutritional value for the insects (Levin, 1973). The present study made effort to explain the role of trichome density against jassids resistance in cotton genotypes.

Material and Methods

The present field experiment was conducted at All India Coordinated Cotton Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri, during kharif season of the year 2020 and 2021. The geographical situation of Rahuri is on 19.38°N latitude and 74.65°E longitude, with an elevation of 511 metres above mean sea level. The experiment was laid out in Randomized Block Design replicated thrice. The field experiment was conducted with gross plot size of 7.20 m x 1.80, whereas net plot size of 5.40 m x 3.60 m.

In present research, 23 cotton genotypes were selected from the All India Coordinated Cotton Improvement Project, MPKV, Rahuri and studied for categorizing this selected cotton genotypes for Jassid resistance by comparing to standard checks i.e., Resistant checks (Ajeet 155 and NDH 1938) and susceptible check (DCH - 32). The treatment details are mentioned below.

Table 1: Treatment / Cotton Genotypes details

T ₁	RHC - 03	T ₁₄	RHC - 1430
T ₂	RHC - 04	T ₁₅	RHC - 1629
T ₃	RHC - 014	T ₁₆	RHC - 1446
T ₄	RHC - 06	T ₁₇	RHC - 1438
T ₅	RHC - 208	T ₁₈	RHC - 1433
T ₆	RHC - 0712	T ₁₉	RHC - 688
T ₇	RHC - 513	T ₂₀	RHC - Hd - 1312
T ₈	RHC - 515	T ₂₁	RHC - Hd - 1433
T ₉	RHC - 566/1-1	T ₂₂	RHC - Hd - 1406
T ₁₀	RHC - 577/3-3	T ₂₃	RHC - 717
T ₁₁	RHC - 1416	T ₂₄	Ajeet - 155
T ₁₂	RHC - 1217	T ₂₅	DCH - 32
T ₁₃	RHC - 1409	T ₂₆	NDLH - 1938

Trichomes bases of resistance: Trichome density of selected cotton genotypes are obtained by using Digital Dinoscope and calculated trichome density per cm².

Number of jassids per 3 leaves: The infestation of Jassids were recorded at 30, 60 and 90 days after sowing during morning hours from five plants per plot of each genotype. The plants were selected randomly and tagged in each plot to record the population of jassids from three leaves, each one from top, middle and bottom canopies and mean populations per three leaves were worked out.

Results and Discussion

Trichome density (per cm²)

The observation on the presence of the number of trichomes (microscopic hairs) per cm² on the lower side of the leaf surface of cotton genotypes were recorded during *Kharif* 2020 and 2021 season, are presented in Table 2 and depicted in Fig.1.

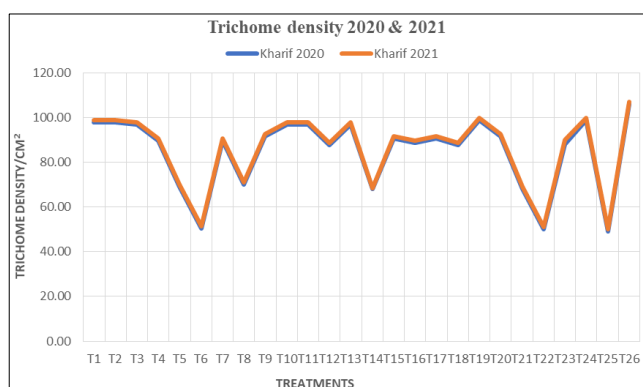


Fig 1: Trichome density (per cm²) of cotton genotypes

Crop season 2020

In present study the results of trichome density among moderately resistant, susceptible and highly susceptible cotton genotypes are in range of 91.67 - 96.67, 68.00 - 70.00 and 49.00 - 50.33 per cm², respectively.

Crop season 2021

In present study the results of trichome density among moderately resistant, susceptible and highly susceptible cotton genotypes are in range of 97.67-92.67, 68.33-71.00 and 50.00-51.33 per cm² respectively.

Pooled data (2020 - 2021)

Among all the cotton genotypes higher trichome density recorded in moderately resistant cotton genotypes as NDH-1938 (106.50/cm²), Ajeet-155 (99.17/cm²) followed by RHC-688 (99.17/cm²), RHC-03 (98.17/cm²), RHC-04 (98.17/cm²), RHC-1409 (97.17/cm²), RHC-1416 (97.17/cm²), RHC-577/3-3 (97.17/cm²), RHC-014 (97.17/cm²), RHC-Hd-1312 (92.17/cm²), RHC-566/1-1 (92.17/cm²), RHC-1629 (91.17/cm²), RHC-1433 (88.17 /cm²), RHC-513 (90.17/cm²), RHC-06 (90.17/cm²), RHC-1466 (89.17/cm²), RHC-1217 (88.17/cm²), RHC-717 (89.00/cm²) and RHC-1438 (91.17/cm²).



The trichome density recorded in certain cotton genotypes as RHC-515 (70.50/cm²), RHC-208 (69.50/cm²), RHC-Hd-1433 (68.50/cm²) and RHC-1430 (68.17/cm²) were classified as susceptible cotton genotypes.

Among all the cotton genotypes the lower trichome density were recorded in RHC-0712 (50.83/cm²), RHC- Hd-1406 (50.50/cm²) and DCH-32 (49.50/cm²) are considered as highly susceptible genotypes.



Fig 2: Recording Trichome density using Digital Dino-scope

Trichomes restrict insect mobility on plant surface by entrapping, immobilizing, impaling them and also inhibits oviposition of various insect pest species on different crop plants thus imparting mechanical resistance. From the present studies, it is clearly evident that the genotypes possessing higher trichome density conferred resistance against the leafhoppers. These findings derive support from studies of Deb *et al.* (2015)^[5] who stated that plant characters *viz.*, hairs or trichomes are responsible for imparting resistance in cotton crop against sucking insect pests. Aslam *et al.* (2004)^[2] also

reported that the leaf hair length and trichome density were important morphic characters contributing to resistance against leafhoppers infesting cotton. Sajjad *et al.* (2004) [9] also reported that the cultivars CRIS-467 and CRIS-134 were resistant to leafhopper due to greatest hair/trichome density. Nizamani *et al.* (2002) [8] and Bashir *et al.* (2001) [4] also concluded that the leafhopper population had negative correlation with hair/trichome density in the leaf.

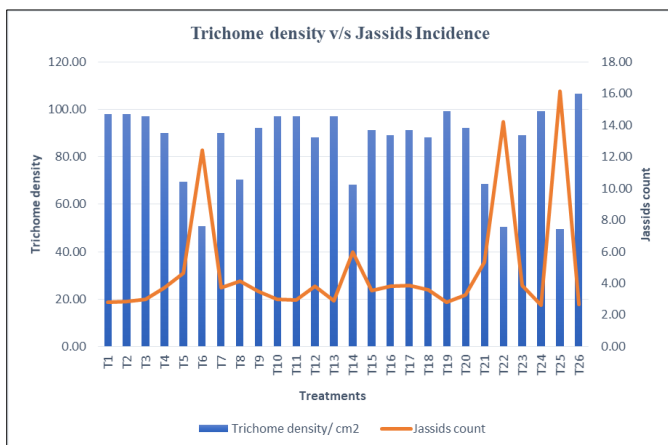


Fig 3: Effect of trichome density (per cm²) of cotton genotypes against jassids incidence

Table 2: Effect of trichome density (per cm²) against jassids resistance in cotton

Genotypes	Trichome density/cm ²		Pooled mean
	Kharif 2020	Kharif 2021	
RHC-03	97.67	98.67	98.17
RHC-04	97.67	98.67	98.17
RHC-014	96.67	97.67	97.17
RHC - 06	89.67	90.67	90.17
RHC-208	69.00	70.00	69.50
RHCr-0712	50.33	51.33	50.83
RHC-513	89.67	90.67	90.17
RHCr-515	70.00	71.00	70.50
RHC-566/1-1	91.67	92.67	92.17
RHC-577/3-3	96.67	97.67	97.17
RHC-1416	96.67	97.67	97.17
RHC-1217	87.67	88.67	88.17
RHC-1409	96.67	97.67	97.17
RHC-1430	68.00	68.33	68.17
RHC-1629	90.67	91.67	91.17
RHC-1446	88.67	89.67	89.17
RHC-1438	90.67	91.67	91.17
RHC-1433	87.67	88.67	88.17
RHC-688	98.67	99.67	99.17
RHC- Hd-1312	91.67	92.67	92.17
RHC-Hd-1433	68.00	69.00	68.50
RHC-Hd-1406	50.00	51.00	50.50
RHC-717	88.00	90.00	89.00
Ajeet-155	98.67	99.67	99.17
DCH-32	49.00	50.00	49.50
NDLH-1938	106.00	107.00	106.50
Mean	84.83	85.85	85.34
S.Em. ±	5.61	6.52	6.08
CD at 5 %	16.33	18.99	17.71
CV	9.25	10.85	10.08

Table 3: Average jassids population of cotton genotypes (Jassids count/3 leaves)

Genotypes	Average jassids population per 3 leaves			Category
	Kharif 2020	Kharif 2021	Pooled mean	
RHC-03	2.83 (1.83)	2.81 (1.82)	2.82 (1.83)	MR
RHC-04	2.86 (1.84)	2.82 (1.83)	2.84 (1.83)	MR
RHC-014	3.01 (1.88)	2.98 (1.87)	3.00 (1.87)	MR
RHC - 06	3.76 (2.07)	3.73 (2.06)	3.74 (2.06)	MR
RHC-208	4.67 (2.28)	4.65 (2.27)	4.66 (2.28)	S
RHCr-0712	12.43 (3.60)	12.39 (3.60)	12.41 (3.60)	HS
RHC-513	3.72 (2.06)	3.68 (2.05)	3.70 (2.05)	MR
RHCr-515	4.15 (2.16)	4.12 (2.15)	4.14 (2.16)	S
RHC-566/1-1	3.52 (2.01)	3.48 (2.00)	3.50 (2.00)	MR
RHC-577/3-3	2.98 (1.87)	2.95 (1.86)	2.97 (1.87)	MR
RHC-1416	2.96 (1.86)	2.93 (1.86)	2.95 (1.86)	MR
RHC-1217	3.84 (2.09)	3.80 (2.08)	3.82 (2.08)	MR
RHC-1409	2.92 (1.85)	2.87 (1.84)	2.89 (1.85)	MR
RHC-1430	6.00 (2.55)	5.97 (2.55)	5.99 (2.55)	S
RHC-1629	3.54 (2.01)	3.49 (2.00)	3.52 (2.01)	MR
RHC-1446	3.82 (2.08)	3.77 (2.07)	3.80 (2.08)	MR
RHC-1438	3.90 (2.10)	3.85 (2.09)	3.88 (2.10)	MR
RHC-1433	3.60 (2.03)	3.56 (2.02)	3.58 (2.02)	MR
RHC-688	2.81 (1.82)	2.77 (1.81)	2.79 (1.82)	MR
RHC- Hd-1312	3.28 (1.95)	3.24 (1.94)	3.26 (1.94)	MR
RHC-Hd-1433	5.34 (2.42)	5.30 (2.41)	5.32 (2.42)	S
RHC-Hd-1406	14.23 (3.84)	14.19 (3.84)	14.21 (3.84)	HS
RHC-717	3.86 (2.09)	3.81 (2.08)	3.84 (2.09)	MR
Ajeet-155	2.65 (1.78)	2.62 (1.77)	2.63 (1.77)	MR
DCH-32	16.16 (4.09)	16.12 (4.08)	16.14 (4.08)	HS
NDLH-1938	2.67 (1.78)	2.62 (1.77)	2.65 (1.78)	MR
S.Em. ±	0.26	0.22	0.24	
CD at 5 %	0.73	0.61	0.68	
CV	7.40	6.22	6.84	

MR-Moderately Resistant, S-Susceptible and HS-Highly Susceptible

Number of jassids per three leaves

The data pertaining to number of jassids per three leaves of cotton genotypes are presented in Table 3 and effect of trichome density on jassids incidence is depicted in fig.2.

More jassids incidence is observed in susceptible cotton genotypes than in resistant genotypes because more number of trichomes are present in leaves of resistant cotton genotypes which confers the resistance against jassids.

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