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Evaluation of cotton (*Gossypium hirsutum*) genotypes for Jassid (*Amrasca biguttula biguttula*) tolerance

Lakshmi Gangavati and Manjula S Maralappanavar

Abstract
Present investigation was conducted to screen selected genotypes of Cotton (*G. hirsutum*) for Jassids (*A. biguttula biguttula*) tolerance. Out of fifteen *G. hirsutum* stabilized genotypes screened for Jassids tolerance, none of the genotypes were completely resistant. However, two entries DHS-9 and DHS-62 were found to be medium resistant with grade 2. The identified medium resistant genotypes can be utilized in crossing programmes involving high yielding genotypes as parents to develop jassid resistant high yielding hybrids in cotton.

Keywords: Evaluation, *Gossypium hirsutum*, *Amrasca biguttula biguttula*, tolerance

Introduction
Cotton, the king of fibre crops or white gold takes a predominant position among the cash crops and contributes a larger share in the economy of India. Cotton is one of the most important raw materials for the textile industry worldwide and known as the 'King of Fiber'. Cotton occupies a pivotal position in the world economy and very often known as the 'White Gold'. Cotton remains the most miraculous fiber, even after 8000 years of its first use and no other fiber comes close to duplicating all of the desirable characteristics combined in cotton.

In the world cotton is grown on an area of 34.67 million hectares producing 121.50 million bales with a productivity of 764 kg ha^{-1}. In India, the crop is being grown on an area of 12.6 million hectares producing 37.10 million bales with a productivity of 473 kg ha^{-1}. India has the distinction of growing all the four cultivated cotton species *viz*. *Gossypium arboreum L*., *G. herbaceum* (both diploids), *G. hirsutum* and *G. barbadense* (both tetraploids). Globally, 90% cotton area is under *G. hirsutum*, 8% is under *G. barbadense* and just 2% is under *G. arboreum* and *G. herbaceum.*

In India, cotton ecosystem is overcrowded with 162 insect pest species, causing monitory yield loss of Rs 2,87,000 million annually (Dhawan *et al.*, 2008). These insect pests fall into three major group *viz.*, sucking pests, defoliators and bollworms. The extent of losses caused by bollworms, sucking pests and both bollworms and sucking pests before the introduction of *Bt* cotton in India had been worked out to be 44, 12 and 52 per cent respectively (Dhawan *et al*., 1988) [2]. Among insects, cotton bollworms are the most serious pests of cotton in India causing annual losses of at least 300 million US$. Among sucking pests, jassid, *Amrasca biguttula* (Ishida) and whitefly, *Bemisia tabaci* (Gennadius) are the important ones causing economic damage to the crop. The sucking pests cause 22.58 percent reduction in cotton yield (Satpute *et al.*, 1990) [5].

In the recent years, incidence of the sucking pest, leafhopper *Amrasca biguttula biguttula* (jassids) became one of the most serious production constraints of this crop not only in India but also in Pakistan, Bangladesh, Thailand and other Southeast Asian countries. This outbreak of jassids or in broad sense sucking pests was mainly due to ignorance towards the IPM measures suggested after the introduction of *Bt* cotton. *Bt* cotton growers reduced or even stopped application of pesticides for bollworm complex which also used to keep in control the sucking pest to some extent, sufficient enough to keep them well below their ETL levels.

Host plant resistance is one of the important tools in IPM to combat the pest throughout the crop stage. Host plant insect interaction is a dynamic system and co-evolutionary process, which involves development of the defense mechanisms by the plants and counter adaptations by the insects.

Defense mechanisms involve either morphological barriers or elaborative array of phytochemicals, which act as repellents, phagodeterrents and oviposition deterrents, thus exhibiting resistance. Incorporating tolerance to boll worms and sucking pests is the present need of cotton breeding program. Developing and growing resistant/tolerant cultivars through breeding for host plant resistance can minimize chemical inputs and protect the environment. With this background the present investigation was conducted to screen selected genotypes of *Gossypium hirsutum* for jassids tolerance.

Material and Methods

The research on screening for jassid tolerance in cotton (*Gossypium hirsutum)* was conducted during *kharif*, 2018 at Agriculture Research Station, Dharwad farm under unprotected conditions.

Experimental material

The experimental material consisted of fifteen *G. hirsutum* stabilized genotypes *viz*., DHS-9, DHS-16, DHS-18, DHS-20, DHS-21, DHS-29, DHS-35, DHS-39 DHS-53, DHS-62, DHS-67, DHS-68, DHS-69, DHS-71 and DHS-72.

Jassid Grading

Plants were visually rated for evidence of hopper burn by adopting 1- 4 grade scale given by Indian Central Cotton Committee (ICCC). Based on grades entries were categorized as resistant (Grade 1), moderately resistant (Grade 2), susceptible (Grade 3) and highly susceptible (Grade 4) according to Sikka *et al.* (1966) [6] with slight modification. Leaf hopper grading was done based on damaging symptoms observations by plant at 60, 90 and 120 DAS.

Table 1: Modified 4-point scale for field screening of cotton genotypes for jassid damage (Sikka *et al.*, 1966) [6]

Grade	Symptoms	Degree of susceptibility
I	Leaves will be normal/little downward curling	Resistant
II	Crinkling, curling, slight yellowing in few leaves on lower portion of the plant	Moderately Resistant
III	Crinkling, curling, yellowing, browning and bronzing in the middle and lower portion	Susceptible
IV	Extreme Crinkling, curling, yellowing, browning, bronzing and drying of leaves, defoliation and stunted growth	Highly susceptible

Results and Discussion

The lowest score was recorded for the genotypes DHS-9 (1.7) and DHS-62 (2.0). The highest score was recorded for the genotype DHS-71 (4).

Table 2: Host reaction of the cotton genotypes for Jassid incidence

Sl. No.	Genotypes	60 DAS	90 DAS	120 DAS	Mean	Host reaction
1	DHS-9	1	2	2	1.7	MR
2	DHS-16	2	3	4	3.0	S
3	DHS-18	2	3	3	2.7	S
4	DHS-20	2	3	4	3.0	S
5	DHS-21	2	3	4	3.0	S
6	DHS-29	2	2	3	2.3	S
7	DHS-35	2	4	4	3.3	HS
8	DHS-39	3	3	4	3.3	HS
9	DHS-53	2	4	4	3.3	HS
10	DHS-62	2	2	2	2.0	MR
11	DHS-67	2	3	4	3.0	S
12	DHS-68	2	3	3	2.7	S
13	DHS-69	1	2	4	2.3	HS
14	DHS-71	4	4	4	4.0	HS
15	DHS-72	2	3	4	3.0	S

The genotypes with the lowest grade were found to be medium resistant while, the genotypes with the highest grade were highly susceptible to jassid incidence. None of the genotypes were resistant to jassids. The genotypes DHS-9 and DHS-62 were found to be medium resistant. The genotypes DHS-16, DHS-18, DHS-20, DHS-21, DHS-29, DHS-67, DHS-68, DHS-72 were characterised as susceptible. Whereas, DHS-35, DHS-39, DHS-53, DHS-69, DHS 71 registered highly susceptibility towards jassid incidence (Table 3).

Table 3: Grouping of cotton genotypes based on their host reaction to jassid incidence

Grade	Degree of susceptibility	Genotypes
I	Resistant	Nil
II	Moderately Resistant	DHS-9 and DHS-62
III	Susceptible	DHS-16, DHS-18, DHS-20, DHS-21, DHS-29, DHS-67, DHS-68, DHS-72
IV	Highly susceptible	DHS-35, DHS-39, DHS-53, DHS-69, DHS 71

Similar results were obtained by Manivannan *et al*., 2017. They screened 350 cotton genotypes for relative susceptibility/resistance against jassids in cotton. None of the genotypes were found to be resistant. Fifty genotypes were categorized as tolerant, 158 genotypes moderately tolerant, 91 genotypes susceptible and 51 genotypes highly susceptible against leafhopper. Study by Asif *et al*., 2018 [1] revealed that NIA-M-20 had comparatively greater resistance to the attack of jassids (0.21/leaf) NIA-HM-6N that registered yield of 2467.8 kg/ha coupled with high tolerance against jassids.

Conclusion

The two identified genotypes, DHS-9 and DHS-62 found to be medium resistant for Jassids can be utilized in crossing programmes involving high yielding genotypes as parents to develop jassid resistant high yielding hybrids in cotton.

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