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Mechanisms of resistance in brinjal (*Solanum melongena* L.) to whitefly *Bemisia tabaci* (Gennadius)

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Abstract: Ten brinjal accessions including two wild accessions were evaluated in glasshouse for their level of resistance and the mechanisms of resistance against *Bemisia tabaci* (G.). The morphological characters *viz.* trichome density, length, breadth and the biochemical characters *viz.* solanine phenols, sugars and pH play a deferential role in the preference of feeding. The accessions TS 00052 and Arka neelakanta were found to have less population and fewer trichome with higher amount of solanine, phenols, lower levels of sugars and pH. The wild type accessions manifested a high level of resistance to *B. tabaci*. (*Key words*: *Bemisia tabaci, Mechanisms of resistance, Trichome, Solanine, Phenols, Sugars, pH).*

Whitefly, *Bemisia tabaci* (Gannadius) (Aleyrodidae : Homoptera) is serious pest of brinjal, okra, cucurbits, potato, cauliflower besides cotton. The nymphs and adults suck the sap from the leaves of brinjal and produce honeydew which results in development of sootymould and drastic yield reduction. Plant resistance is a potential tool in management strategy with regard to integrated approach for control of whitefly in vegetable crops. The objective of this study was to evaluate various brinjal accessions for their level of resistance and mechanisms involved in the accessions against *B.tabaci.*

Materials and Methods

Ten brinjal accessions *viz.* Annamalai, Arka neelakanta, DBR 19, DBR 31, Punjab barsati, Pusa purple long, PY 159, TS 00052 and two wild accessions TS 00018, TS 00051 were screened in the glass house for evaluating the level of resistance. Forty five days old test entries were planted in earthern pots @ one seedling per pot and kept along with brinjal plants heavily infected with whitefly. Twenty five days after exposure the population of nymphs and adults were recorded at the top, middle, bottom leaves on each plant (Gentile *et al.* 1968).

To study the possible mechanism of resistance, the physical components *viz.* trichome density, length and breadth and biochemical components *viz.* solanine, phenols, sugars and pH were analysed. The experiments were replicated four time in Randomized Block Design (RBD). The population level in various accessions were correlated with different morphological and biochemical characters.

Table 1. Reaction of brinjal accession to whitefly *B. tabaci* and leaf trichome density of brinjal accessions

Accessions	Population of white fly		Trichome density		
	Adults/Leaf	Nymphs/ Leaf	Hair density/cm^2	Hairlength (m)	Hairbreadth (m)
Annamalai	27.00(5.19)^{cd}	40.75(6.40)^{de}	1107.60(33.24)^{fg}	405.62(20.13)^{cd}	27.23(5.25)$^{h-j}$
Arka neelakanta	21.50(4.83)^{g}	30.75(5.54)^{g}	847.00(29.09)^{i}	331.06(18.18)^{g}	27.78(5.37)$^{d-g}$
DBR 19	28.75(5.36)^{c}	41.25(6.42)^{bc}	1261.00(35.49)^{e}	328.70(18.10)^{gh}	27.66(5.26)$^{d-f}$
DBR 31	34.75(5.89)^{ab}	42.75(6.54)^{ab}	1650.40(40.60)^{cd}	379.54(19.48)$^{d-f}$	27.36(5.23)$^{d-i}$
Punjab barsati	35.25(5.94)	46.25(4.80)^{a}	1775.20(42.13)c	325.96(18.05)^{gi}	27.65(5.25)$^{d-g}$
Pusa purple lon^{g}	26.25(5.12)$^{c-e}$	37.75(6.14)$^{c-e}$	1067.60(32.66)fh	427.82(20.67)^{c}	27.90(5.28)^{cd}
PY 159	25.00(4.99)$^{d-f}$	(37.00)(6.08)$^{d-f}$	1148.60(33.87)f	382.46(19.54)^{de}	28.62(5.35)^{c}
TS 00018	11.25(3.35)^{l}	18.25(3.26)l	2725.40(52.20)a	714.20(26.73)^{a}	29.62(5.44)^{ab}
TS 00051	13.75(3.70)^{j}	17.25(4.15)ij	2538.20(26.39)b	696.34(18.04)^{ab}	30.00(5.25)^{a}
TS 00052	21.00(4.57)^{gh}	27.75(5.26)^{gh}	698.40(50.37)j	326.06(18.06)$^{g-j}$	27.56(5.26)$^{d-g}$
CD (p=0.05)	0.2864	0.3277	1.5802	0.9373	0.1344

Values in parenthesis are square root transformed.

Table 2. Biochemical components of different brinjal accessions

Accessions	Solanine* (%)	OD phenols (mg g^{-1})	Total phenols (mg g^{-1})	Reducing sugars (mg g^{-1})	Non-reducing sugars (mg g^{-1})	Total sugars (mg g^{-1})	Leaf pH
Annamalai	3.30 $(10.47)^{g}$	2.87 $(1.69)^{h}$	2.50 $(1.58)^{hi}$	8.61 $(2.94)^{cd}$	6.10 $(2.47)^{bc}$	14.71 $(2.44)^{bc}$	5.97
Arka neelakanta	4.88 $(12.76)^{cd}$	4.10 $(2.02)^{c}$	3.68 $(1.92)^{c}$	6.83 $(2.61)^{g}$	4.17 $(2.04)^{g}$	11.00 $(2.42)^{cd}$	5.87
DBR 19	3.04 $(10.03)^{gh}$	2.68 $(1.64)^{i}$	2.69 $(1.64)^{g}$	8.84 $(2.97)^{c}$	5.83 $(2.41)^{cd}$	14.68 $(2.44)^{bc}$	5.97
DBR 31	2.31 $(8.75)^{i}$	2.92 $(1.71)^{gh}$	2.30 $(1.52)^{j}$	9.91 $(3.15)^{ab}$	6.37 $(2.52)^{b}$	16.28 $(2.46)^{b}$	6.03
Punjab barsati	2.16 $(8.46)^{i}$	2.99 $(1.73)^{g}$	2.53 $(1.59)^{h}$	10.23 $(3.19)^{a}$	6.80 $(2.61)^{a}$	17.03 $(3.49)^{a}$	6.20
Pusa purplelong	4.12 $(11.71)^{e}$	3.26 $(1.81)^{f}$	3.06 $(1.75)^{f}$	7.94 $(2.82)^{ef}$	4.87 $(2.20)^{ef}$	12.81 $(2.42)^{cd}$	5.87
PY 159	3.93 $(11.44)^{ef}$	3.45 (11.86)I	3.13 $(1.77)^{e}$	8.11 $(2.85)^{e}$	5.14 $(2.27)^{c}$	13.24 $(2.41)^{de}$	5.80
TS 00018	6.50 $(14.77)^{e}$	5.37 $(2.32)^{b}$	4.73 $(2.18)^{b}$	4.03 $(2.01)^{j}$	2.57 $(1.60)^{i}$	6.60 $(2.38)^{f-h}$	5.63
TS 00051	6.27 $(12.86)^{b}$	5.69 $(2.02)^{a}$	4.84 $(1.91)^{a}$	4.30 $(2.56)^{i}$	2.40 $(1.55)^{ij}$	6.70 $(2.38)^{f-h}$	5.67
TS 00052	4.95 $(14.51)^{c}$	4.07 $(2.39)^{cd}$	3.65 $(2.20)^{cd}$	6.57 $(2.07)^{gh}$	4.00 $(1.99)^{gh}$	10.57 $(2.40)^{d-f}$	5.77
CD (p=0.05)	0.2329	0.0264	0.0174	0.0623	0.0632	-	0.0304

* Values in parenthesis are arc sine transformed.
Values in parenthesis are square root transformed.

Table 3. Correlation of different parameters with *B.tabaci* population

Parameters	'r' value (p=0.05)
Hair density	0.6951
Hair length	-0.8302
Hair breadth	0.4460
Solanine	-0.8779
OD phenols	-07966
Total phenols	-0.8309
Reducing sugars	0.8663
Non reducing sugars	0.8660
pH	0.9467

Results and Discussion

The populations level of *B.tabaci* on various accessions showed a remarkable variation (Table 1). The lowest population density was recorded in both the wild accessions *viz.* TS 00018 and TS 00051. The highest population of nymphs and adults were observed on Punjab barsati (35.25, 46.25) and DBR 31 (34.75, 42.75). Leaf hair density seems to play a crucial role in whitefly host plant relationship. The trichome density on the leaves was minimum on the accessions TS 00052 (698.4/cm^2) and Arka neelakanta (847.0/cm^2) and the population were found to less in these accessions (Table 1). The pubescent nature of host plant favoured whitefly multiplication. The highest population was observed in the accessions DBR31 and Punjab barsati having maximum trichome density of 1650.4/cm^2 and 1775.2/cm respectively. Pollard and Saunders (1956) also recorded differences within a cultivated species of cotton as glabrous varieties carried fewer *B.tabaci* than hariy leafed ones. High pubescent cotton cultivar bear larger population of *B.tabaci* than do glabrous ones (Bindra, 1985). But the wild accessions TS 00051 and TS 00018 which possess maximum hair density (2538.2 and 2725.4/cm^2) showed lesser population, due to presence of wild characters and other biochemical constituents have been unfavourable for whitefly. The trichome hair length of these two wild accessions was longer than other possibly due to non-preference.

The solanine concentration was more in the wild accessions TS 00018 (6.50%) and TS 000.52 (6.27%). The accessions TS 00052 and Arka neelakanta showed 4.95% and 4.88% of solanine content respectively which harbours less whitefly population. It confirms that higher solanine content in the leaves are not preferred by whiteflies (Table 2). The accessions having high population of whitefly are Punjab barsati and DBR31 possess 2.16% and 2.31% of solanine respectively. Pandeya et. al (1981) noted that solanine content was found to increase with plant age and *B.tabaci* preferred younger plants for feeding and oviposition due to lower solanine content. The phenolic compounds were also found to be less in Punjab barsati and DBR 31 (2.53 and 2.30 mg g^{-1}). The OD phenols and total phenol content were more in the wild accessions TS 00051 and TS 00018. The cultivars having greater total phenolic and OD phenols in leaves supported fewer whitefly adults.

The correlation analysis indicated that reducing and non-reducing sugars were positively correlated to whitefly population (Table 3). The high content of total sugars 17.03 and 16.28 mg g^{-1} was observed in the susceptible Punjab barsati and DBR 31. The increase in sugar concentration may favour whitefly and thus a positive correlation was evident. Similar results were obtained by Jayaswal and Pundarikakshkudu (1989). The pH of leaf sap was observed more in the susceptiable accession Punjab barsati and DBR 31 (6.20 and 6.03) and in wild accessions it was less. Berlinger *et al.* (1983) claimed that high pH in susceptible accessions prolonged the feeding period.

The investigation revealed the positive sources of resistance mechanisms found in brinjal accessions. The host plant characters as leaf trichome density and trichome length decide the susceptibility. Solanine and Phenols are negatively correlated and Sugars and pH are positively correlated with the susceptibility. The two wild accessions and the accessions TS 00052 and Arka neelakanta were found to possess a relatively higher level of resistance to *B.tabaci*.

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