



Influence of Biochemical Components of Leaf on Incidence of Whitefly (*Bemisia tabaci* Genn.) in Certain Blackgram Genotypes

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ABSTRACT

Biochemical parameters, viz., phenols and total sugars in leaves were studied in relation to incidence of whitefly (*Bemisia tabaci*) in fifteen genotypes of blackgram. Highly susceptible genotype, LBG-623 had lowest amount of phenols and highest amount of total sugars, when compared to the entry, VBG-10-008 which recorded the lowest whitefly population. It has recorded the highest amount of phenols and lowest amount of total sugars during both vegetative and reproductive stages. There was a significant negative correlation between whitefly incidence and amount of phenols in both vegetative and reproductive stages whereas, significant positive correlation was observed with whitefly incidence and total sugars in vegetative stage and amount of sugars remained nonsignificant in reproductive stage.

Key words : Blackgram, Carbohydrates, Phenols, Whitefly.

The whitefly, *Bemisia tabaci* (Gennadius) derives its pre-eminent importance as a pest of tropical grain legumes from its extremely wide geographical distribution, extensive host range and its ability to spread Yellow Mosaic Virus. In blackgram, *Vigna mungo* (L) it feeds on the leaves and sucks sap from the leaves/ tender parts and acts as vector for mungbean yellow mosaic virus, which is a serious threat to pulse production in India resulting in yield reduction to the tune of 25 – 78 per cent (Vir, 1984).

The allelochemicals such as total sugars and poly phenolic substances occur widely in plants. They play an important role by providing resistance to the plant against insect pests. Therefore the present study was undertaken on the role of phenols and total sugars of the plants on the leaves by *B.tabaci*.

MATERIAL AND METHODS

Studies on infestation of whitefly and estimation of biochemical components such as total sugars and phenols were undertaken in fifteen genotypes viz., IPM 2-43, IPM - 10-4, IPM -10-23, KM – 2293, KPU - 1- 10, KUG – 503, KUG 586, NDU -11 -201, NDU -12 – 300, PU - 08 -05, PU - 09 – 35, TPU – 4, TU- 631, VBG-10-008, LBG – 623 at RARS, Lam, Guntur, Andhra Pradesh during *rabi*, 2013-2014. Each genotype was sown

in two rows of 4 m length in two replications during 1st fortnight of November, 2013. A spacing of 30 cm X 10 cm was adopted and plants were raised duly following all agronomic practices. Five plants were selected randomly in a row of each genotype and observations were made at weekly intervals. Two biochemical parameters, total sugars and phenols in leaves were estimated for their role in varietal differences pertaining to whitefly in all the fifteen genotypes, through the mentioned procedures.

Estimation of Phenols:

Phenols were estimated (Malick and Singh, 1980) using folin reagent in which 0.25 g of fresh leaf was grinded in 5 ml of 80 % ethanol and kept it for 1 hour. Later 1ml of aliquot was collected and 2 ml of 1M Sodium Carbonate (10.6 g in 100 mL distilled water) was added. To this 1mL of folin reagent (1:9 v/v with water) was added and the tubes were kept in water bath for 20mins at 70^o C. The absorbance readings were taken at 765 nm. Standard stock was prepared by using 0.5 g gallic acid in 10 mL ethanol and 90 mL of water and series of different concentrations as standard were made.

Total phenols (mg/ g fresh wt of leaf):
$$\frac{\text{Concentration} \times \text{Qty of Extract prepared}}{1000} \times \text{Weight of the sample}$$

Estimation of Total sugars:

Total sugars was estimated using anthrone method (Hedge and Hofreiter, 1962). Fresh leaf, 0.25 g was ground in 5 mL of 70 % heat ethanol and centrifuged at 5000 rpm for 15 min. Then the supernatant was discarded and air dried the remaining pellet. After air drying 5 ml of anthrone reagent (2 g of anthrone in 1L 10:4 v/v Conc.H₂SO₄) was added and the tubes were kept in icebath at 4^o C for 10 min and immediately the tubes were transferred to waterbath at 80^o C for 30 min. Later, the tubes were cooled to room temperature and the absorbance was read at 620 nm. A series of standard were prepared using fructose (1mg per 10 mL) stock solution.

$$\frac{\text{Total sugars (mg/ g fresh wt of leaf)} \times \text{Concentration} \times \text{Qty of Extract prepared}}{1000} \times \text{weight of the sample}$$

RESULTS AND DISCUSSION

Total sugars

The data (Table 1) indicates that the content of total sugars in leaf was high during vegetative stage when compared to reproductive stage. The total sugars ranged from 34.20 mg/ g (VBG-10-008) to 48.69 mg/ g fresh wt of leaf (LBG-623) during vegetative stage, while it ranged between 27.52 to 32.04 mg/ g fresh wt of leaf, during reproductive stage. More over the genotypes showed statistically significant differences during vegetative stage regarding total sugars, while it was statistically non-significant during reproductive stage. Among all the genotypes, VBG-10-008 recorded the lowest amount of total sugars (34.20 mg/ g fresh wt of leaf) during vegetative stage which recorded lowest population of whiteflies (2.12 nymphs/ trifoliolate/ plant) and significantly superior over all the other genotypes. Whereas the susceptible check, LBG-623 recorded highest amount of total sugars (48.69 mg/ g fresh wt of leaf) during vegetative stage corresponding to the highest incidence of whiteflies (6.98 nymphs/ trifoliolate/ plant). However, significant differences were not observed regarding the total sugars content during reproductive stage among the genotypes (Table 1).

The correlation studies (Table 2) revealed that there was a highly significant and positive

correlation between the population of whiteflies and the amount of total sugars in different genotypes during vegetative stage, while it was non-significant though positive during reproductive stage.

The results clearly indicate that the incidence of whiteflies was high in genotypes with high total sugars and vice versa. The present findings are in agreement with Bommesha *et al.* (2012) who reported significant positive correlation between the incidences of leaf hopper, leaf roller with total sugars in leaves of pigeon pea. Thimmaiah (1992) reported that the total sugar content in the leaves, stem tips, squares and boll rind of cotton genotypes reveals that vegetative parts of susceptible genotypes to insect pests invariably have higher levels of sugars, where as the resistant genotypes have comparatively lower levels of sugars. Thimmaiah *et al.* (1997) reported low polysaccharide in all the tissues of resistant genotypes when compared to the susceptible genotypes in cotton. Halder and Srinivasan (2007) conducted experiment on biochemical basis of resistance in blackgram against *Maruca vitrata* and reported that significant positive correlation between total sugar and pod damage and significant negative correlation between phenol content and pod damage. Acharya and Singh (2008) findings revealed that the total tannin, phenol, and gossypol negatively correlated with the population density of whiteflies.

Phenols

The data (Table 1) revealed that the phenol content was high during vegetative stage and declined during reproductive stage in all genotypes. The phenols content ranged between 12.04 mg/ g to 18.40 mg/ g during vegetative phase, while it ranged from 9.91 to 13.08 mg/g during reproductive stage. Unlike total sugars, the genotype VBG -10-008, which recorded lowest population of whiteflies contains highest amount of phenols during both vegetative (18.40 mg/ g) and reproductive (13.08 mg/g) stages. But, it was found statistically at on par with IPM-10-23 in phenol content during both the growth stages. The susceptible check, LBG-623 recorded lowest amount of phenols during both the growth stages.

The correlation studies (Table 2) revealed that there was a highly significant and negative correlation between the population of whiteflies and

Table 1. Biochemical components of different genotypes.

Genotypes	Whitefly (mean no. of nymphs/ trifoliolate/ plant)	Phenols (mg/g)		Total Sugars (mg/ g)	
		Vegetative stage	Reproductive stage	Vegetative stage	Reproductive stage
IPM 2-43	2.95(1.99) ^{cd}	14.59 ^{cde}	12.26 ^{bc}	40.74 ^{bcd}	30.96
IPM - 10-4	2.93(1.98) ^{bcd}	16.00 ^{bcd}	12.11 ^{bcd}	42.31 ^d	31.14
IPM -10- 23	2.21(1.79) ^{ab}	17.04 ^{ab}	12.78 ^{ab}	40.38 ^{bcd}	30.33
KM - 2293	2.45(1.86) ^{abc}	16.31 ^{bc}	11.82 ^{cde}	37.92 ^b	30.56
KPU - 1- 10	2.79(1.94) ^{abcd}	14.98 ^{cde}	11.61 ^{cde}	41.89 ^d	31.30
KUG - 503	3.07(2.02) ^{cd}	14.68 ^{cde}	11.63 ^{cde}	42.50 ^d	30.72
KUG 586	3.07(2.02) ^{cd}	14.13 ^{de}	11.27 ^e	41.07 ^{bcd}	30.13
NDU -11 -201	3.02(2.01) ^{cd}	13.90 ^{ef}	11.44 ^{de}	38.15 ^{bc}	27.52
NDU -12 - 300	3.12(2.03) ^{cd}	15.03 ^{cde}	11.55 ^{de}	41.71 ^{cd}	29.56
PU - 08 -05	3.26(2.06) ^d	16.08 ^{bc}	12.24 ^{bc}	41.10 ^{bcd}	29.38
PU - 09 - 35	3.26(2.06) ^d	14.75 ^{cde}	11.55 ^{de}	42.36 ^d	28.28
TPU - 4	5.02(2.45) ^e	13.37 ^{ef}	10.34 ^f	43.41 ^d	30.35
TU- 631	5.02(2.45) ^e	13.42 ^{ef}	10.35 ^f	43.60 ^d	30.53
VBG-10-008	2.12(1.77) ^a	18.40 ^a	13.08 ^a	34.20 ^a	27.76
LBG - 623	6.98(2.82) ^e	12.04 ^f	9.91 ^f	48.69 ^e	32.04
F-test	S	S	S	S	NS
SEm±	0.06	0.64	0.23	1.19	
CD (p=0.05)	0.18	1.92	0.68	3.57	
CV%	4.20	6.00	2.76	4.05	

Values in parenthesis are square root transformation values.

S: Significant

NS: Nonsignificant

Table 2. Correlation between biochemical factors of different genotypes and incidence of whiteflies during *rabi* 2013 -2014.

Biochemical factors	Correlation coefficient values
	Whitefly Population
Phenols at vegetative stage	-0.8105**
Total sugars at vegetative stage	0.8197**
Phenols at reproductive stage	-0.8833**
Total sugars at reproductive stage	0.4504
Regression equation - Vegetative stage	Y = 17.17 - 0.2759X1 - 0.2327X2
Regression equation - Reproductive stage	Y = 22.76 - 1.2449X1 - 0.1630X2

** Significant at 1% level

R² Value at Vegetative stage - 0.7850*

R² Value at Reproductive stage - 0.8007*

X1 for biochemical factor: Phenol content

X2 for biochemical factor: Total sugar content

phenol content during both vegetative ($r=-0.8105$) and reproductive ($r=-0.8833$) stages among the genotypes.

The multiple linear regression revealed that the phenols and total sugars together were responsible for 78.50 per cent variation during vegetative phase and 80.07 per cent variation during reproductive stage in the population of whiteflies (Table 2).

The present results are in close agreement with Rao and Panwar (2001) who reported that phenolics in a large concentration could ward off insect pests because of direct toxicity. Shahida Perveen *et al.* (2001) reported that more resistant variety showed 1 to 1.2 mg more phenolics than susceptible varieties at all growth stages. Raghuraman *et al.* (2004) reported that total phenols, ortho dihydroxy phenols, tannins and gossypol showed significant negative relation with egg, nymph and adult of whitefly in upland cotton.

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