

Effect of plant phenotypic characters on the incidence of whitefly *Bemisia tabaci* (Gennadius) in urdbean




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ABSTRACT

Association of plant phenotypic characters viz., leaf size, leaf thickness, glabracity, trichome length and leaf colour with the incidence of *Bemisia tabaci* growth stages i.e. adults, eggs, nymphs and pupae was studied on 12 genotypes of urdbean. The leaf size, leaf thickness, glabracity and trichome length showed positive correlation. The leaf colour did not show any effect on growth stages of whitefly.

Key : *Bemisia tabaci*,  development,  phenotypic characteristics, *Vigna mungo*

Urdbean, *Vigna mungo* (L.) Hepper is one of the most important pulse crops grown throughout the world. Crop is attacked by more than 20 insect-pest species. Several factors are responsible for low productivity of urdbean crop, one of which is losses due to insect-pests on an average, 2.5 to 3.0 million tonnes of pulses are lost annually due to pest problems (Rabindra *et al.* 2004). Urdbean India (Nayar *et al.* 1976) the annual yield loss due to the insect pests has been estimated at about 30 per cent in urdbean and mungbean. The whitefly, *Bemisia tabaci* (Gennadius) (Homoptera : Aleyrodidae) has been found quite serious pest causing substantial reduction in crop yield. It causes severe damage to crops by feeding on sap, secreting honey dew and transmitting virus diseases (Josh and Usha, 2003). Yield penalty of cent per cent under severe conditions have been reported in *Vigna* species due to whitefly (Narasimhan *et al.* 2010). Painter (1968) highlighted the significance of plant resistance in pest management where plant phenotypic and biochemical factors play an important role. Being a less remunerative crop, insect-pest problem of urdbean crop has hardly drawn attention of farmers for control, though crop has a potential to yield 1000 kg/ha under improved production technology. In the present investigations an effort was made to evaluate the plant phenotypic characters of urdbean vis-à-vis the incidence of whitefly on this crop.

MATERIALS AND METHODS

Twelve genotypes of urdbean were sown in plot sizes of 3×3 m in three replications. A distance of 10 cm from plant to plant and 30 cm from row to row was maintained. The crop was raised under recommended agronomical practices. The observations on the occurrence of different whitefly development stages i.e. adult, egg, nymph and pupa were recorded at weekly intervals, initiating with the

appearance of whitefly till the maturity of the crop. The adults were counted on five randomly selected plants from each plot with the help of split cage as suggested by Nath (1994). For recording observations on the leaves per plant (one each from upper, middle and lower plant canopy) from three randomly selected plants per plot were considered. These leaves, *in situ*, were examined under the magnifying hand lens. The emphasis was given to peak occurrence of various stages only, as it has more relevance in host plant resistance studies. The observations on plant-leaf phenotypic characters of each genotype i.e. leaf size (cm²), leaf thickness (mm), glabracity (no of hairs/cm²), trichome length (µm), leaf colour were ascertained. The leaf size was measured with the help of digital leaf area meter, whereas, the leaf thickness was recorded with vernier calliper, glabracity and trichome length were recorded with the help of compound microscope. Leaf colour was measured with leaf colour chart. The correlation between the mean population of different stages of whitefly and the phenotypic leaf characters was worked out to draw the inferences.

RESULTS AND DISCUSSION

The data on the occurrence of different life stages of the whitefly and various leaf phenotypic characters studied are depicted in Table 1. It is clear from the data that there were significant variations in the leaf characters, except leaf colour. Among the genotypes, the leaf size in 'IPU 94-1' was the maximum (18.34 cm²) and it was statistically on par with UH 12-03, UH 12-02, UH 08-05, UH 12-06 and UH 12-05 with leaf size of 18.19, 17.77, 16.60, 16.52 and 16.38 cm², respectively. The smallest leaf size of 15.18 cm² was in UH 1. The leaf thickness was maximum in UH 12-03 (0.48mm) and it was statistically on par with UH 12-05, UH12-17, UH 12-02, UH 12-01 and UH 04-4 with leaf thickness of 0.46, 0.43, 0.42, 0.41 and 0.41 mm, respectively. The data on glabracity and trichome length revealed that minimum number of setae/cm² and trichome length was on T 9, while maximum glabracity and trichome length was recorded on UH 12-17 and UH 12-03, respectively. No significant variation in leaf colour of different genotypes were observed.

The data further revealed that number of whitefly adults (17.82/cage), eggs (30.76/3 leaves), nymphs and pupae (9.14 and 7.33/3leaves) were lowest on 'UH 1' genotype. This genotype had smallest leaf size (15.18cm²),

Table 1. Mean population of *B. tabaci* and phenotypic leaf characters of different urdbean genotypes

Genotypes	Peak occurrence of whitefly stages				Phenotypic characters				
	Adults/ cage	Eggs/ 3leaves	Nymphs/ 3leaves	Pupae/ 3leaves	Leaf size (cm ²)	Leaf thickness (mm)	Glabracity (setae/ cm ²)	Trichome length (µm)	Leaf colour
T 9	18.57 (4.26)	27.10 (5.18)	9.29 (3.15)	7.00 (2.80)	15.30	0.30	57.50	157.65	Green
UH 1	17.82 (4.21)	30.76 (5.44)	9.14 (3.17)	7.33 (2.86)	15.18	0.31	67.50	174.40	Green
UH 04-4	22.98 (4.76)	35.81 (5.77)	10.24 (3.32)	8.71 (3.10)	16.36	0.41	97.50	189.55	Green
UH 08-05	23.36 (4.76)	32.62 (5.58)	9.67 (3.23)	8.10 (2.99)	16.60	0.34	77.75	205.02	Av. green
IPU 94-1	25.57 (5.01)	35.05 (5.68)	10.00 (3.29)	8.19 (3.01)	18.34	0.38	83.00	217.00	Light green
UH 12-01	22.42 (4.67)	36.43 (5.70)	10.00 (3.30)	8.76 (3.10)	15.46	0.41	85.25	177.90	Green
UH 12-02	24.26 (4.88)	36.38 (5.77)	10.29 (3.32)	8.86 (3.11)	17.77	0.42	92.00	216.70	Dark green
UH 12-03	23.86 (4.84)	48.71 (6.42)	11.86 (3.53)	9.48 (3.22)	18.19	0.48	96.25	221.08	Dark green
UH 12-04	23.63 (4.80)	35.05 (5.75)	10.29 (3.29)	8.52 (3.04)	16.33	0.38	93.50	177.62	Light green
UH 12-05	21.81 (4.60)	40.62 (5.96)	10.90 (3.43)	9.24 (3.19)	16.38	0.46	97.25	169.15	Light green
UH 12-06	22.39 (4.66)	35.00 (5.64)	9.57 (3.24)	8.33 (3.02)	16.52	0.35	84.50	191.03	Dark green
UH 12-17	23.78 (4.82)	42.43 (5.94)	10.38 (3.34)	9.05 (3.15)	16.36	0.43	97.75	214.08	Dark green
SE (m)±	(0.07)	(0.13)	(0.04)	(0.04)	(0.67)	(0.03)	(7.67)	(2.61)	
C.D. (P=0.05)	(0.20)	(0.38)	(0.10)	(0.12)	(1.97)	(0.09)	(22.16)	(7.41)	

Figures in parenthesis are $\sqrt{n+1}$ transformed value

minimum leaf thickness (0.31mm) and minimum glabracity (57.5 no of setae/cm²) and trichome length (µm). This clearly shows that the genotype UH 1 exhibited comparative resistance to whitefly due to the possession of these phenotypic characters. On the contrary the genotypes IPU 94-1 and UH 12-03 with larger leaf size, leaf thickness and trichome length was susceptible to the whitefly incidence.

The correlation coefficients between the mean population of different whitefly stages with various phenotypic leaf characters are presented in Table 2. It is evident from this table that leaf size, leaf thickness, glabracity, trichome length were positively correlated with whitefly adults ($r=0.807$, $r=0.605$, $r=0.724$, $r=0.787$), eggs ($r=0.605$, $r=0.922$, $r=0.834$, $r=0.573$), nymphs ($r=0.592$, $r=0.961$, $r=0.805$, $r=0.463$), pupae ($r=0.516$, $r=0.969$, $r=0.937$, $r=0.502$) respectively.

These results are in conformity with Balaji and Veerval (1994) who observed higher number of eggs of whitefly on MDU-1 genotype of brinjal and with higher number of leaf hairs. Panghal *et al* (2008) observed that cultivar MH 435 exhibited comparative resistance to whitefly due to the possession of smallest leaf size (63.77cm²), minimum hairs (48.50 hairs/cm²) and highest specific leaf weight (6.19mg/cm²). Kular and Butter (1999) observed positive correlation between whitefly adult population and leaf area and negative correlation with leaf thickness= specific leaf weight

Table 2. Correlation of phenotypic characteristics of urdbean leaves with whitefly adults, eggs, nymphal and pupal population

Phenotypic characters	Whitefly adults	Egg	Nymph	Pupa
Leaf size	0.807**	0.605**	0.592**	0.516
Leaf thickness	0.605*	0.922**	0.961**	0.969**
Glabracity	0.724**	0.834**	0.805**	0.937**
Trichome length	0.787**	0.573*	0.463	0.502

*Significant at 0.01 Level, ** Significant at 0.05 Level

in case of cotton. Ayyasamy and Baskaran (2005) reported negative correlation between *B. tabaci* adults and leaf thickness on brinjal. However, Castane and Albajes (1992) observed that less hairy pelargonium leaves were preferred by whitefly. Butter and Vir (1989) reported more whitefly incidence on thick leaves of cotton.

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