*Journal of Food Legumes* 31(1): 33-35, 2018

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

REENA SAINI, TARUN VERMA, ROSHAN LAL and YPS SOLANKI

Department of Entomology, CCS Haryana Agricultural University, Hisar-125004, Haryana, India; E-mail: vermatarun27@gmail.com

*(Received : June 08, 2017; Accepted : November 18, 2017)*

## 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 any growth stages of whitefly.**

***Key words:*** *Bemisia tabaci*, Pest development, Plant phenotypic characteristics, *Vigna mungo*

Urdbean, [*Vigna* mungo (L.)] Hepper is one of the most important pulse crops grown throughout the world. Urdbean crop is attacked by more than 20 insect-pest species in India (Nayar *et al.* 1976). Several factors are responsible for low productivity of urdbean crop, one of which is losses due to insect-pests. 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). On an average, 2.5 to 3.0 million tones of pulses are lost annually due to pest problems (Rabindra *et al.* 2004). Yield penalty of cent per cent under severe conditions have been reported in *Vigna* species due to whitefly (Narasimhan *et al.* 2010). Painter (1968) has 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 management, though crop has a potential to yield 1000 kg/ha under improved protection & 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 populations were recorded 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 ($cm^2$), leaf thickness (mm), glabracity (no. of hairs/$cm^2$), trichome length (µm) and leaf colour were recorded. 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$cm^2$) 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 $cm^2$ respectively. The smallest leaf size of 15.18 $cm^2$ 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 12-01and 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/$cm^2$ 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

**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 "n+1transformed value

pupae (9.14 and 7.33/3leaves) were lowest on 'UH 1' genotype. This genotype had smallest leaf size (15.18$cm^2$), minimum leaf thickness (0.31mm) and minimum glabracity (57.5 no of setae/$cm^2$) 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 94-1and UH 12-03 with larger leaf size, leaf thickness and trichome length was susceptible to the whitefly.

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.

**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

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 (63.77$cm^2$), minimum hairs (48.50 hairs/$cm^2$) and highest specific leaf weight (6.19mg/$cm^2$). Kular and Butter (1999) observed positive correlation between whitefly adult population and leaf area and negative correlation with leaf thickness and specific leaf weight 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 and Butter and Vir (1989) reported more whitefly incidence on thick leaves of cotton.

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