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THE SUSCEPTIBILITY STUDY OF SOME AUBERGINE (*Solanum melongena* L.) CULTIVARS AGAINST JASSID (*Amrasca biguttula biguttula* (ISHIDA).

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The jassid (*Amrasca biguttula biguttula* (Ishida) is an emerging serious pest of brinjal crop in Pakistan. The present study was carried out for evaluating relative plant resistance/susceptibility of different cultivars of brinjal against the jassid during summer 2009 at PARS, Faisalabad, Pakistan. Fourteen cultivars of brinjal viz. Pusa Purple Round (PPR), Rubi, Vrib-01, Vrib-02-F1, Dilnasheen, Vrib-0401, Vrib-04, Bemissal, Vrib-9901, Nirala, Qaisar, JK_Kajal, Cluster King and Purple QL were tested for their susceptibility against jassid. All the tested cultivars showed significant differences ($P \leq 0.05$) for the tested parameters viz. pest preference, host plant susceptibility indices (HPSI) as well as yield/plot. The peak infestation time of the pest after sowing of crop was 1st week of June after which it gradually declined. The cultivars Nirala, Bemissal and Vrib-04 appeared as comparatively susceptible showing high population of jassid/leaf while Vrib-9901, Vrib-0401, and Vrib-02-F1 appeared as intermediate and Rubi, Vrib-01 and Cluster King were observed comparatively as resistant ones with least number of jassid/leaf. The cultivar Bemissal proved the most susceptible varietyamong the tested ones showing maximum level of HPSI (18%) and minimum fruit yield (44.66 kg/plot) while Rubi proved the most resistant cultivar with minimum HPSI (7%) and a maximum fruit yield (81.0 kg/plot).

Keywords: Brinjal, *Solanum melongena* L., susceptibility**,** jassid, yield, screening

INTRODUCTION

Brinjal (*Solanum melongena* L.), also called aubergine (Europe) or eggplant, is very common and popular vegetable crop in Pakistan. It is mainly grown in China, India, Indonesia, Egypt, Turkey, Iraq and Pakistan. It is well adapted to adverse environmental conditions like high temperatures and high rainfall and can provide high yields in hot-wet environments as well (Hanson *et al.*, 2006). It is grown over 8670 hectares area throughout Pakistan with the annual production of 91260 tons, out of which Punjab has the highest share in terms of area of sowing (4890 hectares) and production (60890 tones) (Anonymous, 2007). It is rich in nutrients, dietary fibre, vitamins (K, niacin, B6, pantothenic acid), various mineral nutrients like iron, magnesium, potassium etc (USDA, 2009); a valuable addition of nutrients in the diets of poor.

In Pakistan production of eggplant is severely constrained by several insect and mite pests. Of these brinjal jassid, *Amrasca biguttula biguttula* (Ishida) is the second most important insect pest after brinjal fruit and shoot borer (Ahmed, 1986; Nagia *et al.*, 1993; Mall *et al*., 1992). This is the most severe pest in Pakistan (Mahmood *et al*., 1990) as well as in India (Kumar and Singh, 2002). Jassid can damage from premature seedling stage to the fruit setting stage, resulting in a loss of 50% in yield (Bindra and Mahal, 1981). Rawat and Sadu (1973) resulted jassids can reduce 49.8% and 45.1% number of leaves and decrease in the height, respectively.

Growers mainly rely on excessive use of chemical pesticides to combat this menace. Intensive pesticide use in brinjal crop increases the cost of production, making the crop expensive for consumers. On the other hand, the indiscriminate use of pesticides has adverse effects on the environment and human health. A sustainable management can help growers decrease their reliance on chemical pesticides.

Host Plant Resistance is one of the safe & cost-effective methods used in various crops. WTO has set the limitations for highest residual levels especially for the horticultural crops. So it is necessary to introduce some non-chemical methods of insect pest control in vegetables. The growth and the selection of resistant cultivars to the crop insect pests is vital approach of integrated pest management (Bhatti *et al.*, 1976).

Resistant genotypes may give a base on which to build an integrated control system and it shows good result when used in combination with other control methods. Keeping in view the importance of resistant genotypes, the present research work was carried out to evaluate the response by various accessible varieties of brinjal to jassid to determine

resistant or susceptible lines. The categorization of resistant genotypes of high yield against brinjal jassid will provide a baseline for an effective and sustainable management of this pest by the farmers.

MATERIALS AND METHODS

***Preliminary brinjal varietal screening trial*:** The study was conducted at Post-graduate Agricultural Research Station (PARS), Faisalabad during summer 2009, in a Randomized Complete Block Design (RCBD) having 14 treatments with the three replications, to screen out the brinjal varieties on the bases of relative jassid infestation and per plot yield by different cultivars. The seeds of the fourteen brinjal varieties viz., Pusa Purple Round (PPR), Rubi, Vrib-01, Vrib-02-F1, Dilnasheen, Vrib-0401, Vrib-04, Bemissal, Vrib-9901, Nirala, Qaisar, JK_Kajal, Cluster King and Purple QL were procured from the Vegetable Research Station, Ayub Agricultural Research Institute (AARI) Faisalabad and the vegetable market of Multan, Punjab, Pakistan. The brinjal seedlings were sown in the experimental field on February 16, 2009. The plot size was kept as 20 x 25 feet^2, with R×R and P×P distance was 36cm and 30 cm, respectively. No plant protection measures were adopted for any pest and genotypes were selected under natural insect pest infestation. All the recommended agronomic practices were adopted during the experiment. The crop was surveyed daily for the appearance of jassid population which actually appeared on 7th of April. Afterwards it was visited at an interval of week time till harvesting of fruit for comparison of yield data. The varietal resistance was decided at the time of maximum population of jassid on all varieties which was observed to be on 3rd of June. The selection of genotypes was done on the bases of pest infestation and fruit yield.

***Population density counts*:** The data were recorded at weekly base after the appearance jassid (adult and nymph). To count the jassid population, 15 plants of each genotype, in each replication, were selected at randomly and also tagged for further. Collection of the data took in such a way that one leaf of the upper part of the first plant, one leaf of the middle part from the second plant and one leaf of the bottom part of the third plant, of each variety, was taken to in account. The total of 15 leaves, were taken, per treatment, for recording the population data of jassids.

The average population/leaf (nymph and adult) for each genotype was calculated by the simple arithmetic means using the following formula,

$$X = \frac{X_1+X_2+X_3+, \cdots +X_{14}+X_{15}}{N}$$

Where: N = Total numbers of plants,
X = Mean plant^{-1}, and
$X_1+X_2+X_3+, \cdots +X_{14}+X_{15}$ = Number of observed plant

***Host plant susceptibility indices (HPSIs)*:** Host Plant Susceptibility Indices based on per leaf population of jassid (adult/ nymph) from the various selected varieties of brinjal individually and on cumulative basis were calculated by using Excel Microsoft chart package and IBM compatible computer. The objective of this test was to check the level of susceptibility of each genotype. The HPSI (%) was calculated with the following formula:

$$\text{HPSI (\%)} = \frac{B - A}{B} \times 100$$

A= Population of pest (Adult/Nymph) in individual variety.
B= Population of pest (Adult/Nymph) in all varieties on average basis.

***Fruit yield data*:** The fruits yield (Kg/plot) of different brinjal cultivars in each treatment of each replicate from 1st picking to last picking was recorded for comparison.

***Statistical analysis*:** The analysis of variance (ANOVA) was calculated and means were separated by Duncan's New Multiple Range Test (DMR) at α 0.05 by using M stat-C computer generated software. (Steel *et al*., 1997).

RESULTS

***Period of abundance*:** As the varietal resistance was considered at the time of maximum population/ leaf of jassid hence different dates of observations were analyzed statistically. The data regarding comparison of means of jassid population between the different dates of observation during the study period on different varieties of brinjal is presented in Table 1. The results revealed on the whole a highly significant variation in the mean values for the population estimates of brinjal jassid. The appearance of the jassid was noted on the crop as 0.37/leaf on April 07, 2009 which gradually increased up to 20th of May, 2009 and after decreasing during the last week of May, 2009 reached to a maximum level of 3.97/leaf on 3rd June, 2009. A more critical review of the situation indicates that the maximum jassid population was observed on 3rd June and minimum population on April 7th, 2009.

***Varietal screening*:** The data regarding population of brinjal jassid per leaf on different commercial genotypes of brinjal on 3rd June 2009 is presented in Table 2. Highly significant differences between the jassid population/leaf on different brinjal cultivars were observed. It is evident from the results that the variety Bemissal recorded maximum jassid population i.e. 3.38 / leaf which differed significantly from all the other varieties of brinjal. The population of jassid recorded on all other varieties viz., PPR, Rubi, Vrib-01, Vrib-02-F1, Dilnasheen, Vrib-0401, Vrib-04, Vrib-9901, Nirala, Qaisar, JK_Kajal, Cluster King and Purple QL were 2.72, 1.43, 1.61, 1.82, 1.75, 1.95, 2.95, 1.82, 3.13, 1.72,

2.69, 1.60 and 2.41 respectively. The minimum number of jassid was recorded to be 1.43 / leaf on Rubi which showed highly significant difference from all other brinjal cultivars and highly resistant one.

Table 1. Mean population of jassid on different brinjal varieties at various dates of observation in the preliminary trial during 2009 at PARS.

Dates of Observation	Mean Population of Jassid (Leaf^{-1})
April 07, 2009	0.37 j
April 14, 2009	1.15 h
April 21, 2009	1.33 g
April 28, 2009	2.26 e
May 06, 2009	3.45 b
May 13, 2009	3.52 b
May 20, 2009	1.86 f
May 27, 2009	3.14 c
June 03, 2009	3.97 a
June 10, 2009	2.87 d
June 17, 2009	1.86 f
June 24, 2009	0.78 i
LSD at P = 0.05	0.11
SE	± 0.04

The means sharing similar letters are not significantly different by DMR Test.

Table 2. Mean population of jassid/leaf on different brinjal cultivars on June 3, 2009 in preliminary trial at PARS.

Name of cultivars	Mean Population of Jassid(Leaf^{-1})
PPR	2.72 d
Rubi	1.43 j ***
Vrib-01	1.61 i ***
Vrib-02-F1	1.82 g **
Dilnasheen	1.75 h
Vrib-0401	1.95 f **
Vrib-04	2.95 c *
Bemissal	3.38 a *
Vrib-9901	1.82 g **
Nirala	3.13 b *
Qaisar	1.72 h
JK_Kajal	2.69 d
Cluster King	1.60 i ***
Purple QL	2.41 e
LSD value at P = 0.05	0.07
S.E	± 0.02

The means sharing similar letters are not significantly different by DMR Test.
Where, * = Susceptible** = Intermediate*** = Resistant

***Host plant susceptibility indices*:** The results regarding host plant susceptibility indices based on population of jassid/leaf in various selected varieties of brinjal during 2009 are shown in Fig. 1. It was evident from the results that genotype Bemissal showed maximum level of HPSI i.e., 18% and proved the most susceptible variety followed by Vrib-0401 (15%). The minimum HPSI was recorded to be 7% in Rubi. The genotypesVrib-04, Vrib-02-F1, Vrib-01, Cluster King, Nirala and Vrib-9901 each showed 10%, 9%, 8%, 8%, 16%, and 9% HPSI respectively and were found intermediate genotypes.

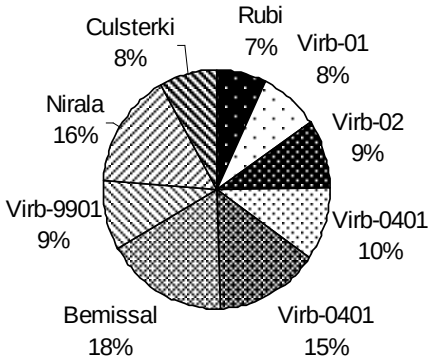

Figure 1. Host plant susceptibility indices of different selected genotypes of brinjal

***Fruit yield*:** The data of fruit yield was recorded from each plot in each replication of different genotypes of brinjal. The results (Fig. 2) revealed highly significant differences among genotypes. The means were compared by DMR test (P=0.05). The genotype Rubi showed a maximum fruit yield (81.0 kg/Plot), which was significantly different from statistical point of view from those recorded in all other genotypes. Similarly, the genotype Bemissal showed a minimum fruit yield (44.66 kg/plot) which was also statistically different significantly from those recorded in all other genotypes. The fruit yields from other genotypes were Vrib-01 (77.18 kg/plot), Cluster King (76.04 kg/plot), PPR (71.33 kg/plot), Dilnasheen (71.81 kg/plot), Qaisar (70.33 kg/plot), Purple QL (69.48 kg/plot), Vrib-02-F1 (61.10 kg/plot), Vrib-9901 (60.77 kg/plot), Vrib-0401 (58.26 kg/plot), JK-Kajal (55.17 kg/Plot), Vrib-04 (50.71 kg/plot) and Nirala (48.15 kg/plot).

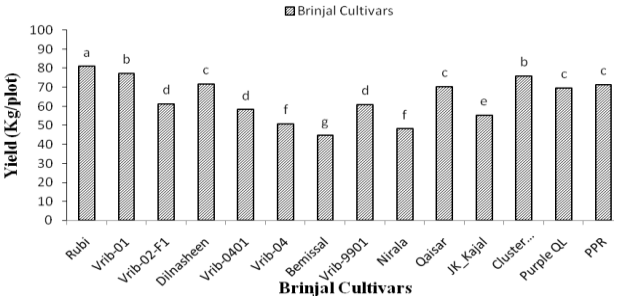

Figure 2. Mean Fruit yield (Kg/plot) as shown by various genotypes of brinjal in 2009 at PARS, Faisalabad.
Bars with similar letters are not significantly different by DMR test at α=0.05.

DISCUSSION

The varietal resistance was decided at the time of maximum jassid population per leaf of brinjal varieties. Looking at the results of abundance period, the population of jassid increased gradually and reached maximum on 3rd June, 2009. The population estimates during different dates showed a highly significant variation in the mean values of jassid/leaf in all the treatments.

On the other hand during preliminary screening trials of fourteen different cultivars at the maximum insect pest activity date, the minimum population was observed at the Rubi (1.43/leaf) and the maximum population of the target pest was observed at the Bemissal (3.38/leaf). The present study was confirmed by the Reddy and Srinivasa (2001) who assessed nine aubergine genotypes against different insect pestsespecially of leafhopper *(A. biguttula biguttula*). Sonali Deole (2008) screened out different genotypes of brinjal jassid on the per leaf bases. Khaire and Lawande (1986) screened out 49 aubergine genotypes under the natural conditions against insect pest of brinjal especially *A. biguttula biguttula* This finding is in conformity with those of Singh (1988), Sharma and Sharma (1997) and Kumar (2002), they all reported jassid on the brinjal crop.

In the present study, 3 varieties showed relatively resistance response (Rubi, Cluster King and Vrib-01) with low jassid population, 3 varieties showed intermediate results (Vrib-02-F1, Vrib-0401 and Vrib-9901) while rest of the genotypes showed susceptible response (Bemissal, Nirala and Vrib-04) towards the population density.

The variety Rubi showed most resistance response while Bemissal as the susceptible one. In the present study, the trend of susceptible and resistance varieties are similar which was recorded in the initial trial 2009. This study is in conformity with that of Mote (1982) who screened out 10 genotypes of brinjal against jassid and checked the resistance under the laboratory & field conditions. The present findings cannot be compared in more precise terms as with those of Taylo and Bernard (1995) and Lokesh and Singh (2005) because of the differences in the cultivars tested.

The Host Plant Susceptible Indices again confirms the same findings as in the preliminary varietal screening trials. Similarly the results of yield trials revealed that less yield has been obtained from the plots where more attack of jassid has been observed. As a matter of fact, the cultivar Rubi showed maximum yield (81.0 Kg/plot) and its HPSI is also very low (7 %) and during the time of maximum insect activity on all other varieties it has very low population (1.43/leaf). Similarly, the cultivar Bemissal showed minimum yield (44.66 Kg/plot) and its HPSI is also high (18 %) and during the time of maximum insect activity on all other varieties it had very high population (3.38/leaf).

The present studies are in conformity with those of Gogoi and Dutta (2000) who reported that jassid population was maximum in the last week of May 1998 (37.53 nymphs/ leaf), and mid-April during 1999 (30 nymphs/ leaf) and when the crop approached maturity, decline of jassid started. On the other hand these studies cannot be compared with those of Sharma and Sharma (1997), Uthamasamy (1980), Patel *et al*. (1997), Rai and Satpathy (1999), Kumawat *et al.* (2000) and Lokesh and Singh (2005) because they reported various period of abundances which may be due to the variation between ecological conditions and sowing dates.

Similar type of results were observed by Jamshaid *et al.*, (2010) who studied that maximum population of the brinjal jassid was recorded during the third week of June. Similarly, Shivanna *et al.* (2011) reported that the highest population of the jassid was noted during the 2nd fortnight of May.

On comparing the results obtained i.e. the mean jassid population/leaf on overall bases we can clearly divide all the cultivars into three different groups. The cultivars Nirala, Bemissal and Vrib-04 appeared as comparatively susceptible while Vrib-9901, Vrib-0401, and Vrib-02-F1 appeared as intermediate and Rubi, Vrib-01 and Cluster King were observed comparatively as resistant ones.

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