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Screening of Brinjal (*Solanum melongena* L.) Varieties Sown in Autumn for Resistance to Cotton Jassid, *Amrasca bigutulla bigutulla* (Ishida)

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Abstract.- The study was conducted to screen varieties of brinjal, *Solanum melongena* L. sown in autumn for resistance to cotton jassid, *Amrasca bigutulla bigutulla* (Ishida). Brinjal seedlings of nine varieties, *viz*, Bemisal, Black Beauty, Black Pearl, Dilnasheen, Hybrid 888, Hybrid 3715, Hybrid Shilpa, Nirala and Round Black were grown in pots and transplanting was done on September 04, 2011. Experiment was planned in a randomized complete block design. Number of jassids (adults + nymphs) were counted in early morning hours on the underside of three leaves from each plant by randomly selecting two plants from each of the two middle rows of plots. Jassids were counted from three leaves, *i.e.*, one from the upper one third, one from the middle one third and one from the lower one third of each plant. Highest number of the cotton jassid was observed on the Black Beauty variety, whereas varieties Nirala and Hybrid 3715 had the lowest number of jassid per leaf on most of the sampling dates. Seasonal mean number of jassid per leaf on different varieties was in the order; Black Beauty (14.7±0.4) > Dilnasheen (3.8±0.17) > Hybrid Shilpa = Round Black (3.3±0.2) >Bemisal (3.0±0.16) > Hybrid 888 (2.7±0.13) > Black Pearl (2.5±0.19) > Hybrid 3715 (2.4±0.19) > Nirala (2.3±0.13). In this respect Black Beauty was considered the most susceptible variety bearing the highest number of jassid per leaf (14.6±0.4). Subsiquently, Dilnasheen, Hybrid Shilpa, Round Black, Bemisal, with jassid number from 3.3±0.2 to 3.8±0.17 per leaf., were moderately resistant and Hybrid 888, Black Pearl, Hybrid 3715 and Nirala, with jassid population ranging from 2.3 to 2.7 per leaf, were resistant against jassid. It is concluded that all the varieties screened, except Black Beauty, can be part of integrated management strategy for cotton jassid on brinjal. Jassid per leaf on all the varieties started to build from 49 days after transplanting (DAP) and reached a peak on 63 DAP. Thereafter number per leaf decreased up 84 DAP.

Key words: Aubergine, eggplant, host-plant resistance, population dynamics.

INTRODUCTION

Brinjal (*Solanum melongena* L.) is an important solanaceous vegetable crop in sub-tropics and tropics. It is extensively grown in India, Pakistan, China, Philippines, Bangladesh, Egypt, France, Italy, Middle East, Far East and U.S.A. (Anonymous, 2010). It is a good source of nutrients, minerals, antioxidants, vitamins, dietary fiber and body building factors and proteins (Matsubara *et al.*, 2005; Obho *et al.*, 2005). One hundred grams of fruit contains 0.7mg iron, 13.0mg sodium, 213.0mg potassium (Nonnecke, 1989), 12.0mg calcium, 26.0mg phosphorus, 5.0mg ascorbic acid and 0.5 International Units of vitamin A and provides 25.0 calories (Tindall, 1978). In Pakistan, it occupies 9,044 ha area and its production is 88,148 tonnes (FAO, 2012). Yield of brinjal in Pakistan has been reported to be 97,466 kg/ ha. Insect pests are one of the important causes of yield reduction and limiting factors in production of brinjal. Several insect pests attack brinjal from time of planting till harvesting. Some of the important insect pests of brinjal in Pakistan are brinjal fruit borer, *Leucinodes orbonalis* Guenee (Lep., Pyralidae), brinjal stem borer, *Euzophera perticella* Ragonot (Lep., Pyralidae), leaf roller, *Eublemma olivacea* (Walker) (Lep., Noctuidae), beetle, *Epilachna vigintioctopunctata* Fabr. (Col., Coccinellidae), aphid, *Aphis gossypii* (Homop., Aphididae),

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Whitefly, *Bemisia tabici* (Genn.) (Hemip., Alerodydidae), thrips, *thrips palmi* Karny (Thysanop., Thripidae) (Sirinavasan, 2009). Cotton jassid (CJ), *Amrasca biguttula biguttula* (Ishida) (Hemiptera: Cicadellidae) is also a serious pest in Pakistan (Ahmad, 1986; Mall *et al*., 1992; Nagia *et al*., 1993; Mahmood *et al*., 2002;). Adults and nymphs of CJ feed on the underside of the leaves by sucking plant sap, which results in yellowing and curling of leaves. It also injects toxic material into the leaves, which causes necrosis. The blades of severely infested leaves show burn symptom and such leaves may ultimately drop down (Rahman, 2009). Damage caused by CJ to brinjal could be up to 54 percent (Rawat and Sahu, 1973). Chemical control is commonly practiced by the farmers for management of insect pests on brinjal, and the CJ on other vegetables (Aslam *et al*., 2004; Rahman *et al*., 2009; Latif *et al*., 2010; Saimandir and Gopal, 2012). This control method results in environmental contamination, bio-accumulation of chemicals in the ecosystem, health hazards and induction of resistance to insecticides (Dadmal *et al*., 2004). Host plant resistance is a preventive control measure, which is compatible with integrated pest management (IPM) strategy. Growing resistant varieties, such as ISD006, BL114 and BL095 has been recommended as a control method for CJ on brinjal by Alam *et al*. (2003). Screening of brinjal varieties have been done by a number of researchers. Gaiwad *et al*. (1991) reported that brinjal varieties KB9, Pusa Purple Long, KP10 and BB1 were tolerant to CJ. In another study, a large number of varieties were reported to be resistant against CJ (Elanchezhyan *et al.,* 2008). Suiza (1997) in a study on resistance of brinjal to CJ identified 19 brinjal accessions, which exhibited high level of resistance to CJ. According to Lit (2009a) varieties A 300 (Mistasa), Abar, Parat, EG 2003, Mara and Acc 612 were resistant to CJ in a four year resistance study in Philippines. On the basis of number of leafhoppers per leaf on different cultivars of brinjal, Mahmood *et al.* (2002) concluded that the cultivars, Purple Long, Nepali and Neelum were resistant, Sigatoka Beauty and Sitara were moderately susceptible and Chayat, Greek, Local Gool, Violetta, Prospara and Violetta Lunga were most susceptible. Lit *et al.* (2002) screened one hundred and seventeen eggplant genotypes for resistance against CJ and reported that 28 entries were resistant, 69 were moderately resistant, 15 were intermediate and one (Acc 544 White) was the most susceptible to leafhopper.

Although host plant resistance alone or in combination with other methods is environmentally safe and compatible with IPM, however this strategy is practical only when resistant varieties of crops are available and identified. Even a moderate level of resistance in a crop can have a positive impact and can reduce the number of pesticide applications (Srivastava, 1993). Population level of CJ per leaf has been identified as a good criteria for declaring the varieties as resistant or susceptible (Bindra and Mahal, 1981).Thus, the present study was conducted to screen nine brinjal varieties for resistance against CJ so that the varieties having tolerance or resistance can be used alone or in combination with other control methods for effective management of CJ.

MATERIALS AND METHODS

The study was conducted on the farm of the COMSATS Institute of Information Technology, Sahiwal (30°39′52″N 73°6′30″E) during growing season in 2011. Nine brinjal varieties including Bemisal, Black Beauty, Black Pearl, Dilnasheen, Hybrid 888, Hybrid 3715, Hybrid Shilpa, Nirala and Round Black were assessed in the trial. Seeds of Bemisal, Dilnasheen and Nirala were obtained from the Ayub Agricultural Research Institute, Faisalabad and of the others, which are from India, were purchased from the vegetable seed market. Seeds of all the varieties were sown on July 12, 2011 in 30 cm earthen pots to grow in the nursery. Seedlings were transplanted in the field on September 4, 2011. Planting was done just after irrigation on one side of 50.0 cm apart ridges. Plant to plant spacing was also 50.0 cm. Four rows with length of 5.0 m were planted of each variety in the plots. The experiment was laid out in a Randomized Complete Block Design having four replications. Plots and replications were separated by one and two meter non-cropped area, respectively. The agronomic practices were the same for all the treatments (varieties).

CJ appeared during late October on the crop, but data recording was started on November 2, 2011 when reasonable numbers to be recorded were present on the leaves. Data were recorded from the middle two rows of each plot. Number of CJ per leaf was considered as indicator of resistance/ susceptibility. Number of CJ (adults + nymphs) was counted in early morning hours, when insect was less active, on the underside of three leaves from each plant by randomly selecting two plants from two middle rows in each plot. The three leaves chosen were; one from the upper one third, one from the middle one third and one from the lower one third of each plant. Data recording was continued for six weeks at weekly intervals. Number of CJ per leaf was calculated for each plot. The data were analyzed by Analysis of Variance (ANOVA) using Minitab (Minitab, 2010) statistical software. Also the least significance difference (LSD) was calculated, for comparisons of means, using MSTAT-C (MSU, 1993) statistical package.

RESULTS AND DISCUSSION

When CJ population on the tested varieties was compared on different sampling dates (Table I) Black Beauty had the highest population followed by that on Dilnasheen and Hybrid Shilpa whereas, Black Pearl, Hybrid 3715 and Nirala had the lowest number of CJ per leaf on November 2. Other varieties had intermediate level of population. On November 9, similar trend was observed, *i.e.* number of CJ was significantly higher on Black Beauty followed by that on Dilnasheen and Hybrid Shilpa. Population trend was also almost similar as for sampling on November 2. The varieties Hybrid 3715 and Nirala had the lowest population and Bemisal and Black Pearl had significantly higher population than those two varieties, but lower than all other varieties. Rest of the varieties were intermediate based on number of CJ per leaf. On Novenber 16, again highest population was found on the variety Black Beauty followed by that on Dilnasheen and lower population was recorded on Nirala followed by that, in ascending order, on Hybrid Shilpa, Bemisal, Hybrid 888 and Black Pearl, which had non-significant difference in population among themselves. On November 23, Black Beauty had the highest number of CJ per leaf followed by that on Dilnasheen and Hybrid Shilpa. The varieties Bemisal, Hybrid 3715 and Nirala had lower population. On November 30, Black Beauty again had the highest number of CJ per leaf but the second highest number was on Bemisal and Round Black, and lowest number was noted on Nirala, Hybrid 3715 and Black Pearl. On December 7, CJ population was highest on Black Beauty again followed by Dilnasheen and lowest population was recorded on Black Pearl and Hybrid 888. The results indicate that the highest number of CJ per leaf was observed on the variety Black Beauty on all sampling dates. The variety Dilnasheen had significantly and consistently lower population than that on Black Beauty, but higher than all other varieties screened on five out of six sampling dates. The varieties Nirala and Hybrid 3715 had the lowest number of CJ per leaf on most of the sampling dates.

When overall seasonal mean (total number of CJ recorded on all sampling dates / number of sampling dates) was considered, the number of CJ per leaf on different varieties was in the order; Black Beauty > Dilnasheen > Hybrid Shilpa = Round Black >Bemisal > Hybrid 888 > Black Pearl > Hybrid 3715 > Nirala (Fig. 1). In our study the variety Black Beauty consistently had the highest and Nirala had the lowest population. Similar results, but for different varieties, have been reported by Mahmood *et. al.* (2002).According to them Violetta Lunga and Prospara brinjal varieties had consistently higher and Nepali and Purple Long lower CJ population. Comparison of the results of our study with an earlier study by Mahmood *et al.* (2002) reveals that sampling interval has no effect on the trend of mean seasonal population per leaf. Some varieties had consistently higher and some had lower mean seasonal population. Similar trend was observed on most of the sampling dates in the present study also. However, in their experiment mean seasonal population, which ranged from 0.74 to 16.71 CJ per leaf as compared to our experiment in which population ranged from 2.3 to 14.7 CJ per leaf. The difference in lowest and highest population could be due to different varieties used in the two studies and different environmental conditions in which the work was done.

Table I.- Number of cotton jassid, *Amrasca biguttula biguttula* (Ishida) (adults + nymphs) per leaf on different varieties of brinjal, *Solanum melongina* L. at Sahiwal during 2011.

Varieties	Sampling dates					
	Nov. 2	Nov. 9	Nov. 16	Nov. 23	Nov. 30	Dec. 7
Black Beauty	12.0±0.76a	22.0±1.16a	19.1±0.85a	11.4±0.78a	19.4±0.16a	4.0±0.31a
Dilnasheen	2.9±0.27b	4.5±0.35b	6.8±0.47b	3.2±0.32b	3.2±0.30bc	2.2±0.21b
Hybrid Shilpa	2.7±0.32bc	4.3±0.39bc	4.8±0.31cd	3.7±0.35b	3.1±0.39bc	1.3±0.12cd
Bemisal	2.2±0.26bcd	3.0±0.27cd	4.5±0.28cd	2.1±0.21d	4.3±0.39b	1.8±0.12bc
Hybrid 888	2.2±0.18bcd	3.4±0.24bcd	4.2±0.34cd	2.8±0.31bcd	2.9±0.23bc	0.9±0.12e
Round Black	1.8±0.19cd	3.2±0.29bcd	4.9±0.36c	2.3±0.31cd	4.3±0.53b	1.2±0.13de
Black Pearl	1.7±0.23d	3.0±0.35cd	4.20.34±cd	2.2±0.40cd	3.4±0.42bc	0.2±0.13e
Hybrid 3715	1.6±0.15d	2.5±0.21d	4.0±0.35cd	2.1±0.26d	2.6±0.20c	1.3±0.16de
Nirala	1.5±0.17d	2.7±0.21d	3.6±0.36d	2.0±0.27d	2.6±0.29c	1.6±0.17cd
LSD	**0.92**	**1.32**	**1.24**	**1.07**	**1.37**	**0.52**

Means followed by the same letter in columns are non-significantly different (LSD at P= 0.05).

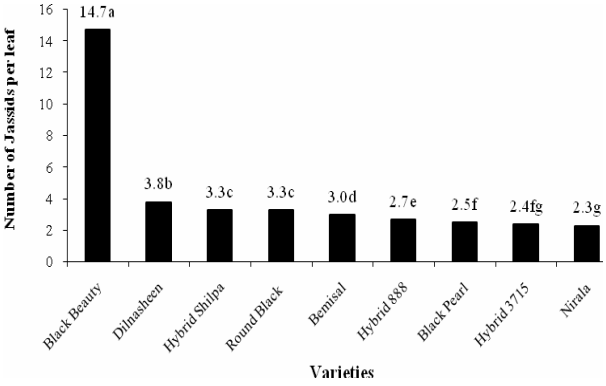

Fig. 1. Mean seasonal (total jassids counted/ number of sampling dates) number of cotton jassids, *Amracsca bigutulla bigutulla* per leaf on different brinjal varieties at Sahiwal during 2011.

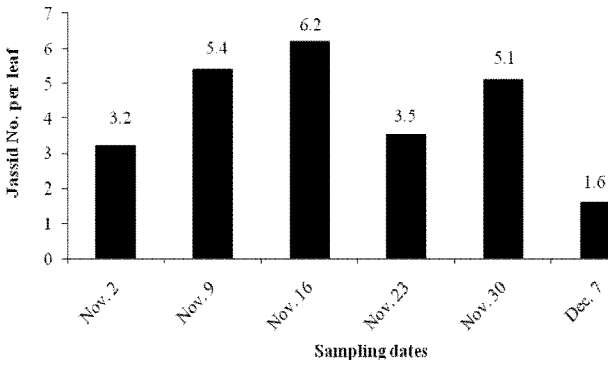

Fig. 2. Number (averaged over varieties) of cotton jassid, *Amracsca bigutulla bigutulla* per leaf of brinjal at Sahiwal during 2011.

Results of our study indicated that at least four varieties can be considered as resistant based on the seasonal mean number of CJ per leaf. Rashid *et al*. (2002) classified brinjal varieties into two categories, *i.e.* highly resistant and resistant. According to them varieties having 4 to 5 CJ per plant were highly resistant and having 7 to 9 were considered as resistant. If CJ per plant are calculated, population in the present study is quite higher as compared to their results. Therefore, their classification is not applicable for results of our study. Our results are not in agreement with those of Kisha (1981), who reported that the variety Black Beauty was tolerant to CJ than Long Purple. However, in our study CJ species was *Amrasca biguttula biguttula* and according to our results Black Beauty was tolerant to CJ, but has been recorded as non-tolerent variety to *Empoasca lybica* (Kisha, 1981). Our results are also different from those of Elanchezhyan *et al*. (2008), who reported that when 25 brinjal varieties were screened CJ number varied between 0.00 and 6.80 per leaf on different varieties. In the present study number of CJ per leaf was higher (2.3 to 14.6) than they had reported. The difference could be due to the varieties used in the experiment and location where the work was done. It was revealed after reviewing a number of studies that the results of the brinjal varietal screening against CJ cannot be quite well compared among different studies because different researchers used different varieties under different

environmental conditions (Suiza, 1997; Mahmood *et al*., 2002; Rashid *et al*., 2002; Deole, 2008).

When population dynamics was considered during the growing season (Fig. 2) on the basis of number of CJ per leaf (total number of CJ counted/ number of samples taken), it was observed that population started to build from early November (49 days after transplanting (DAT)) and reached a peak on November 16 (63 DAT). Thereafter number per leaf decreased up to early December (84 DAT) and no CJ was found in mid December (91 DAT). Results of our study are quite similar to those reported by earlier workers (Lit *et al*., 1999; Lit *et al*., 2002), who observed that CJ adult population started to increase 45 DAT of brinjal and peaked at 60 DAT. Lit (2009b) found that CJ population started to increase 45 DAT and peaked at 75 DAT. These results are slightly different than the present results for the days the population reached the peak.

In conclusion, based on the seasonal mean number of CJ per leaf, brinjal variety Black Beauty, having 14.6 $\pm$ 0.4 CJ per leaf, was highly susceptible, Dilnasheen, Hybrid Shilpa, Round Black and Bemisal, with CJ number from 3.0 $\pm$ 0.2 to 3.8 $\pm$ 0.17 per leaf, were moderately resistant and Hybrid 888, Black Pearl, Hybrid 3715 and Nirala, with CJ population ranging from 2.3 to 2.7 per leaf, were resistant against CJ. All the varieties screened, except Black Beauty, are recommended as a component of an integrated pest management strategy of the CJ on brinjal.

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