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Host suitability of brinjal jassid *Amrasca biguttula biguttula* (Cicadellidae: Hemiptera) among different aubergine genotypes in Pothwar region

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Abstract

The present study was conducted at University Research Farm Koont, during the year 2014. Six brinjal cultivars were tested for their host suitability against the Jassid. The results revealed that maximum number of nymphs and adult were observed on Giant Round cultivar with 0.35 and 1.35 per leaf respectively. The minimum population of nymphs and adult were observed on Pusa Purple Long with 0.01 and 0.01 per leaf respectively. According to physico-morphic characters the maximum numbers of hairs on leaf lamina and leaves midrib were recorded on Pusa Purple Long cultivar with 279.00 and 72.25 cm² and minimum on Giant Round with 186.75 and 23.00 cm² respectively. Highest plant height was noticed on Pusa Purple Long with 61.92 cm while the minimum brinjal plant height was observed on Giant Round i.e. 44.59 cm. Brinjal plant stem girth on Giant Round was higher with 54.70 cm and minimum on Pusa Purple Long with 28.42 cm. Maximum yield was observed on Pusa Purple Long with 0.42 kg while the Giant Round had low yield of 0.04 kg. So Pusa Purple Long has been recommended for the cultivation in the Pothwar region.

Keywords: Brinjal, *Amrasca biguttula biguttula*, physico-morphic and abiotic factors

1. Introduction

Brinjal *Solanum melongena* L. also known as eggplant is an important vegetable crop that is extensively grown throughout the world. It is cultivated on a large scale in Pakistan, Bangladesh, China, Philippines, India, France and U.S.A. [1]. In Pakistan, it is grown on an area of 9,044 hectare and production range is 88,148 tonnes [2]. Brinjal plant have extended amount of nutrients such as protein 1.1%, carbohydrate 0.02% and water 92.7%, besides this have good supply of calories as well as vitamin A and B³. In the world brinjal is considered as a delicious vegetable [4]. The eggplant is such a type of vegetable which is favored of numerous insect pests from the initial stage till harvesting. The important insects are aphids, whiteflies, thrips, brinjal stem and fruit borer, leaf roller and jassid are notorious pest [5]. Jassid is a dangerous pest of many crops in Pakistan and causes extensive yield losses towards the brinjal crop [6]. It causes the damage at initial stage of crop growth and affects the transport system of conducting vessels. It also injects a toxin material into leaves which effects photosynthesis [7]. Both nymphal and adult form causes severe damage in such a way by feeding on the underneath of leaves and suck plant the sap. And as a result, plant color turns in to yellowing ultimately curling of leaves will be done. When it sucks the plant sap, it plays a role in injecting the toxic substance that in fact seriously damaged the leaves expose burning signs and in this way the leaves fall down [8]. Brinjal Jassid is such a serious pest of the eggplant that infest voraciously from the seedling stage to fruiting stage, it causes 50 % yield losses of brinjal plant [9]. Brinjal jassid (*Amrasca biguttula biguttula*) lays its eggs on midrib of leaves and feeding constantly on the plant cell-sap [10]. In brinjal cultivation constraints are attack of pests and diseases. Farmers in the tropics Countries use more insecticides to manage the pest population. It kills non- target organisms or the beneficial insects [11]. Mostly, chemical control is used in the form of synthetic chemicals to manage the brinjal insect pests and is used at broad spectrum which is cause environmental pollution and biomagnification of toxic residues are affecting the ecological balance [12]. Resistant and tolerant cultivars form is the basic component of integrated pest management (IPM) over which other components is to

be built up. It contributes helpfully in IPM in two ways: reduces the quantum of insecticides and improves performance of natural enemies in plants. Even a low level of tolerance in plants has a dramatic effect, which in fact reduces the need of insecticides [13]. Feeding and egg laying of the insect pests is affected by the physico-morphic characteristics of plants and fruits. Development of resistant varieties against insect pests is an important practice [14]. In plants the introduction of morphological and physical characteristics responsible for resistant against insect pests may lead to resistant genotypes. The resistant genotypes had more hairs than the non-resistant varieties. On the leaves, the degree of trichomes presents intensively and show resistance against phytophagous insects [15]. The density of trichomes and emergence of *A. biguttula biguttula* had significantly negative correlation [16].

Keeping in view the importance of brinjal crop the present study was conducted to evaluate different brinjal cultivars against brinjal jassid. It will help to increase the brinjal yield and facilitate small farmer community for growing of this important vegetable.

2. Materials and Methods

The experiment was conducted in a Randomized Complete Block Design (RCBD) to evaluate different cultivars of brinjal along with four replications at University Research Farm Koont, during the year 2014.

2.1 Research Area

Pakistan has different climates in different regions. Summer season is hot and rainy in Rawalpindi while winter season is cold and dry. In summer season the average temperature of Rawalpindi region is about 34.2 °C and in winter season the average temperature is about 16°C. In winter season mean maximum and minimum temperatures are 16.6 °C and 3.4 °C respectively. Annually recorded average rainfall is 1143mm and annually recorded relative humidity is about 55%. The different brinjal cultivars were collected for field experiment as well as for the screening of brinjal cultivars against brinjal jassid.

2.2 Screening of Brinjal Cultivars

Brinjal nursery of six different brinjal cultivars was grown in nursery raising plastic trays in the Entomological department of PMAS-Arid Agriculture University Rawalpindi. By proper caring the nursery was prepared for transplanting within 55 days. Transplanting of the brinjal seedlings to the experimental plots was done after 55 days of germination of seedlings. Land preparation was done using standard farm operations. The plot size was dimension 40 × 40 ft. The distance from plant to plant and row to row was maintained as 60 cm and 75 cm respectively. Application of water was given according to the requirement of seedlings. Data regarding nymph and adult population of brinjal jassid was started after 1st week of transplantation of brinjal seedlings on five different randomly selected plants from each replication till the harvesting.

2.3 Nymphal Population

The numbers of nymphs were counted from underneath portion of upper, middle and lower leaves of five randomly selected plants of each cultivar. Data of nymphal infestation was taken on the weekly basis from 1st week of transplanting till the harvesting of crop. The average was calculated by using the following formula:

$$\text{Average number of nymphs per leaf} = \frac{\text{Total no. of nymphs counted}}{\text{Total no. of leaves observed}}$$

2.4 Adult Population

The number of adults was counted from underneath portion of upper, middle and lower leaves of five randomly selected plants of each cultivar. Data of adult infestation was taken on the weekly basis from 1st week of transplanting up to harvesting of crop. The average was calculated as:

$$\text{Average number of adults per leaf} = \frac{\text{Total no. of adults counted}}{\text{Total no. of leaves observed}}$$

2.5 Statistical Analysis

The data regarding the population pattern of brinjal jassid on different brinjal cultivars and physico-morphic characters of various varieties were subjected to statistical analysis and means were compared with Duncan's Multiple Range (DMR) test at 5% level of probability. Then, the data was processed for simple correlation.

3. Results

3.1 Screening of different Brinjal Cultivars against Brinjal Jassid

3.1.1 Nymphal Population

The different brinjal cultivars were evaluated to investigate the nymphal population in the 2014. The data on the brinjal jassid nymphal population exposed and the minimum number of nymphs were recorded on Pusa Purple Long and comparative resistant cultivar with 0.01 nymphs per leaf. Giant Round was the moderate susceptible and statistically different from other cultivars with 0.35 nymphs per leaf. It is also evident from these findings that Sirhindi Long and Short Purple cultivars were similar to each other's with 0.11 and 0.12 nymphs per leaf respectively (Table 1).

3.1.2 Adult Population

The means of brinjal jassid adult population on all brinjal cultivars were analyzed by DMRT at P=0.05 and results showed that Giant Round was the moderate susceptible cultivar and have maximum adult presence with 1.35 adults per leaf. The minimum adults' population was recorded on Pusa Purple Long, a comparatively resistant and significantly different from others with 0.01 adults per leaf. The results also revealed that the cultivars Sirhindi Long and Short Purple were similar among each others with 0.11 and 0.12 adults per leaf respectively (Table 1).

3.2 Physico-morphic characters on different Brinjal cultivars during the year 2014

3.2.1 Number of hairs (cm)² on fruit crown of brinjal cultivars

The data on to the hairs (cm)² densities on plant of brinjal fruit crown was measured and their analysis of variance was also calculated. The means of data relating to hairs (cm)² density on brinjal fruit crown was compared by DMRT at P=0.05 value. The results showed that the Pusa Purple Long cultivar had maximum hair density on fruit crown area and significantly different from others with 14.24 hairs per leafcm². The minimum hair density on fruit crown area was recorded on Giant Round and moderate susceptible cultivar with 3.83 hairs per leaf. Round Black and Short Purple these were statistically similar to each others with 7.5 and 7.7 hairs per leafcm² respectively (Table 1).

3.2.2 Number of hairs on the leaf lamina per cm² of different brinjal cultivars

The data regarding number of hairs on the leaf lamina per cm² of different cultivars of brinjal was calculated along with the analysis of variance. The results revealed that on the Pusa Purple Long maximum number of hairs on the leaf lamina per cm² was observed and comparative resistant cultivar with 279.00 hairs per leaf cm². The results also exposed that the minimum hairs density on the leaf lamina was recorded on Giant Round (186.75) and statistically different from the other cultivars (Table 1).

3.2.3 Density of hairs on leaves midrib per cm² of the brinjal cultivars

The data regarding to the hairs (cm)² densities on leaves midrib per cm² was measured and their Analysis of variance was also calculated. The results showed that the maximum number of hairs on the midrib hairs was on Pusa Purple Long and comparative resistant cultivar with 72.25 hairs per leaf cm². Giant Round cultivar had minimum hair density on leaves midrib and significantly different from the others with 23.00 hairs per leaf cm² (Table 1).

3.2.4 Height of different brinjal cultivars after 40 days of transplantation

The data related to the height of different brinjal cultivars after 40 days was measured and their analysis of variance was also calculated. The Pusa Purple Long was significantly different from all other five cultivars with the mean height of 30.78 cm and proved resistant cultivar against the brinjal jassid followed by Sirhindi Long, Green Long, Round Black and Short Purple with 29.69, 18.28, 15.29 and 10.80 cm per leaf respectively (Table 1).

3.2.5 Height of different brinjal cultivars after 70 days of transplantation

The means of data regarding plant height were compared by DMRT at P=0.05 value. It is evident from these results that, the Pusa Purple Long cultivar had highest plant height, proved comparatively resistant and significantly different from others with 54.70 cm followed by Sirhindi Long, Green Long, Giant Round, Round Black and Short Purple with 48.36, 42.08, 30.33, 29.64 and 28.42 cm respectively (Table 1).

3.2.6 Height of different brinjal cultivars after 100 days of transplantation

The means of data regarding plant height were compared by DMRT at P=0.05 value. The results revealed that Pusa Purple Long was comparatively resistant and statistically different from all other five cultivars with 61.92 cm followed by Sirhindi Long, Green Long and Giant Round with 59.16, 51.04 and 44.59 cm respectively (Table 1).

3.2.7 Plant stems girth in (mm) on different brinjal cultivars after 40 days of transplantation

Data relating to different brinjal plant stem girth after 40 days were measured and results showed that Giant Round had long stem girth and moderate susceptible cultivar with 27.89 mm. It is also evident from these findings that Pusa Purple Long (24.45 mm) was shortest stem girth and comparative resistant cultivar (Table 1).

3.2.8 Plant stems girth in (mm) on different brinjal cultivars after 70 days of transplantation

The data regarding plant stem of different cultivars of brinjal

after 70 days were calculated results exposed that Giant Round was the moderate susceptible cultivar with highest stem girth and significantly different from others with 46.78 cm. The findings also exposed that Pusa Purple Long had minimum stem girth of brinjal plant and comparatively resistant cultivar with 35.59 cm. Short Purple and Round Black these two cultivars were statistically similar to each others with 36.61 and 37.14 cm respectively (Table 1).

3.2.9 Plant stems girth in (mm) on different brinjal cultivars after 100 days of transplantation

The means of data regarding plant stem girth were compared by DMR Test at 0.05 P value. The results showed that Pusa Purple Long was the resistant and significantly different among all other cultivars with shortest stem girth i.e. 28.42 cm. It was also evident from these findings that Giant Long had highest stem girth and showed the most susceptible cultivar with 54.70 cm. Sirhindi Long and Short Purple were statistically similar to each other with the average mean stem girth of 29.64 and 30.33 mm respectively (Table 1).

3.2.10 Yield (Kg) per plant of different brinjal cultivars

The data relating to the comparison of yield in kg of different brinjal fruits were calculated. Analysis of variance and means were compared by DMRT at P=0.05 showed that the average yield comparison (kg) of different brinjal fruits were significantly different to each others. The results revealed that the Pusa Purple Long gave the highest yield 0.42(kg) followed by Sirhindi Long, Round Black, Short Purple, Green Long with 0.20, 0.08, 0.07 and 0.07 (kg). Least yield was recorded in Giant Round with 0.04 due to the susceptibility of brinjal jassid. The results showed that Giant Round cultivar was susceptible and Pusa Purple Long was resistant variety against brinjal jassid (Table 1).

3.3 Discussion

In the present study, six cultivars of brinjal namely Pusa Purple Long, Sirhindi Long, Round Black, Short Purple, Green Long and Giant Round were studied for the population distribution pattern of brinjal jassid *Amrasca bigutulla bigutulla* at weekly interval throughout the season during the year 2014. The population density was recorded on the basis of their population pattern per leaf on different randomly selected aubergine cultivars. There was a significant variations in the population dynamics among the treatments and as well as in the time interval. These results can be compared with different researchers' work for the evaluation of brinjal jassid population towards the different aubergine germplasms. The results of the present research showed that Pusa Purple Long revealed comparatively resistant while the Giant Round cultivar proved moderately susceptible towards the behavior of brinjal jassid. Sirhindi Long, Round Black, Short Purple and Green Long genotypes exposed in-between susceptibility against brinjal jassid *Amrasca bigutulla bigutulla*. These results are in agreement to [17] who performed an experiment to find out the relative resistance as well as susceptibility level among various aubergine cultivars such as Bemisal, Black Beauty, Black Pearl, Dilnasheen, Hybrid-888, Hybrid-3715, Hybrid Shilpa, Nirala and Round Black. They reported that Round Black was moderate susceptible cultivar with 3.3 adults per leaf. The present findings are somewhat similar to [18] who investigate the varietal resistance among various aubergine cultivars and reported that Purple Long was the relative resistant cultivar with 0.74 adults per leaf and yield comparison also showed that Purple Long had highest

yield of about 42.34 tonnes/hectares. Similar results were reported by ^[19] in which authors reported that the physico-morphic characters play significant correlation with the brinjal jassid population pattern.

They showed the hair density on the leaves of brinjal plant was the chief component for the resistance of brinjal jassid towards the aubergine cultivars. The hair density present on the leaves vines of eggplant is also the main symbol for resistance phenomenon against jassid abundance. The current study results were also inconformity to those of ^[20] in which authors stated that the hairs density on the leaves of vines that strongly correlate with the oviposition that exposed negative and significant findings. The present results were also resemble with ^[21] who described the strongly significant and negative relationship between trichome length, density of leaf hairs of brinjal plant and the number of primary branches play significant role in the reduction of adult oviposition on eggplant germplasms. The present study findings were highly accordance with ^[22] they reported that jassid appearance has negative and significant correlation with the hair thickness. The present research was also in agreement of ^[23] who reported that physico-morphic characteristics play their main role in correlation with the leaves of brinjal cultivars. The results of ^[24] are in agreement with the present study in which hair length on the leaves midrib, hair length on the veins of leaves and plant height showed negative and significant relationship with the pest population distribution pattern.^[25] recorded that Round Black was in-between moderate susceptible cultivar towards the brinjal jassid which are similar to the result of current study. ^[26] described the hair density on the leaves and hair length were most fruitful physico-morphic factors in fluctuation pattern of oviposition on aubergine genotypes that shows resembles to the present findings.

Table 1: Mean comparison data number of nymphs, adult population of *A. bigutulla bigutulla* and physico-morphic characters on brinjal cultivars per leaf during 2014.

Cultivars	Nymph of <i>Amrasca bigutulla bigutulla</i> per leaf	Adult of <i>Amrasca bigutulla bigutulla</i> per leaf	Physico-Morphic Characters									
			Number of hairs on crown	Number of hairs on lamina of fruit	Hairs on the leaf midrib	Height of plant cm after 40 days	Height of plant cm after 70 days	Height of plant cm after 100 days	Stem girth of plant mm after 40	Stem girth of plant mm after 70	Stem girth of plant mm after 100	Yield of brinjal
Pusa Purple Long	0.01 ^a	0.01 ^a	14.24 ^a	279.00 ^c	72.25 ^a	30.78 ^a	54.70 ^a	61.92 ^a	24.45 ^a	35.59 ^c	28.42 ^c	0.42 ^a
Sirhindi Long	0.11 ^a	0.11 ^b	12.5 ^b	261.00 ^d	51.50 ^b	29.69 ^b	48.36 ^b	59.16 ^b	24.84 ^a	35.71 ^c	29.64 ^c	0.20 ^b
Round Black	0.19 ^a	0.25 ^c	7.5 ^c	257.50 ^d	40.57 ^c	15.29 ^d	29.64 ^d	42.29 ^d	26.46 ^a	37.14 ^c	42.08 ^b	0.08 ^c
Short Purple	0.12 ^a	0.12 ^c	7.78 ^c	231.25 ^c	44.25 ^c	10.80 ^c	28.42 ^c	39.59 ^c	25.76 ^a	36.61 ^c	30.33 ^c	0.07 ^c
Green Long	0.31 ^b	0.46 ^d	4.15 ^d	211.25 ^b	31.00 ^d	18.28 ^b	42.08 ^b	51.04 ^b	27.36 ^a	40.61 ^b	48.36 ^{ab}	0.07 ^c
Giant Round	0.35 ^b	1.35 ^e	3.83 ^d	186.75 ^a	23.00 ^c	15.15 ^c	30.33 ^c	44.59 ^c	27.89 ^a	46.78 ^a	54.70 ^a	0.04 ^d
Analysis	F5, 239=1.23 p<0.01ns	F5, 239=0.26 p<0.00**	F5, 23=112.96 p<0.0000****	F5, 23 =149.50p<0.0000 ***	F5, 23 =131.57p<0.0000 ***	F5, 23 =37.08p<0.0000 ***	F5, 23 =27.04p<0.0000 ***	F5, 23 =48.75p<0.0000 ***	F5, 23 =3.93p<0.1882 ns	F5, 23 =27.04p<0.0000 ***	F5, 23 =61.60p<0.0000 ***	F5, 65 =4.67p<0.0000 ***

Mean sharing similar letters are not significant different by DMR Test at P=0.05

3.4 Conclusion

According to the present study, Pusa Purple Long is the comparatively resistant cultivar as it has the lowest nymphal and adult population of *Amrasca biguttula biguttula* and has the highest yield of 0.42 kg per plant among all the brinjal cultivars. The physico-morphic characters also revealed that the Pusa Purple Long cultivar have the maximum number of hairs on the leaf lamina as well as on the midrib per cm², highest plant height and shortest stem girth among the brinjal cultivars and consider as the least susceptible cultivar. Finally, the present study recommended Pusa Purple Long for the cultivation in Pothwar region.

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