PERFORMANCE EVALUATION OF TEN JAPANESE BRINJAL (Solanum melongena L.) VARIETIES

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Accepted for publication on 7 January 2015

ABSTRACT


An experiment was conducted to evaluate the performance of ten Japanese brinjal varieties (coded from V1-V10) at Horticulture farm, Sher-e-Bangla Agricultural University, Bangladesh during February 2013 to August 2013. Tallest plant (68.9 cm), maximum number of leaves (61.7), maximum number of flower buds/plant (23.7) and longest fruit (11.5 cm) were found from V1 but maximum number of flowers/plant (21.4), number of fruits/plant (20.6), fruit diameter (53.3 mm), fruit weight (97.5 g), yield/plant (2.0 kg) and yield/plot (23.6 kg) was obtained from V6. Fruits of V4 varieties were less susceptible (24.3%) to the brinjal fruit and shoot borer whereas V3 was reported as the most susceptible (66.3%).

Key words: brinjal variety, genetic diversity, cluster analysis, growth and yield

INTRODUCTION

Brinjal (Solanum melongena L.) is an important vegetable crop in sub-tropics and tropics. It is a good source of nutrients, minerals, antioxidants, vitamins, dietary fiber and body building factors and proteins (Matsubara et al. 2005; Obhio et al. 2005). Insect pests are one of the important causes of yield reduction and limiting factors in production of brinjal. Brinjal fruit borer (Leucinodes orbonalis Guen. Lep., Pyralidae), is the major insect pest of Brinjal in Bangladesh (Alam and Sana, 1964), India (Tewari and Sardana, 1990) and major pest in some other countries of the world (Dhankar 1988). The intensity of the infestation by this pest may go over 90% (Ali et al. 1980; Kalloo 1988) and yield loss may estimate up to 86% (Ali et al. 1996), 67% (Islam and Karim, 1991) in Bangladesh. Application of different kinds of chemicals can reduce the infestation of brinjal fruit and shoot borer but it can cause several pesticides related complication and toxic residues in the fruits, killing the beneficial population and pollution in the environment in all brinjal growing areas in Bangladesh. Growing resistant varieties against brinjal fruit and shoot borer is environmental friendly and economically sound as well. Genetic variability of brinjal has been studied by many researchers in India (Misra 1961; Thakur et al. 1968) and also in Bangladesh (Basar 1999; Chowdhury 2005). Considering this view point the present study was conducted to find out the suitable variety regarding growth, yield and resistant against brinjal fruit and shoot borer.

MATERIALS AND METHODS

Experiment was conducted at Horticulture farm, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period of February 2013 to August 2013 following Randomized Complete Block Design (RCBD) with three replicates. The unit plot size was 2.8 m × 2.1 m. Ten Japanese brinjal varieties coded from V1-V10 were exerited in the experiment, collected from Sakata seed company, Japan. 70 cm × 70 cm spacing was maintained. Manures and fertilizers were applied as recommended by Bangladesh Agricultural Research Institute (Mondal et al. 2011). The entire amount of organic manure, TSP, Gypsum, Borax and half of the MP were applied during final land preparation. The remaining half of MP and entire urea were applied in two equal installments. 1st at 15 days after planting and 2nd at flowering stage. Data were collected on plant height, leaf number, number of branch/plant, number of bud/plant, number of flower, number of fruit, fruit length, fruit diameter, fruit weight, yield/plant, yield/plot, calculated yield/ha and fruit susceptibility to brinjal fruit and shoot borer (BFSB) (%). Collected data were statistically analyzed using MSTAT-C program, means were calculated and differences between treatments were evaluated by Least Significance Difference (LSD) test at 5% level of significance (Gomez and Gomez, 1984). To determine the genetic similarities of the studied brinjal genotypes and to group them, cluster analysis was performed using the squared Euclidean and WARD method (Hoque and Rahman, 2006) using SPSS (Statistical Package for the Social Sciences).

RESULTS

Tallest plant was observed in variety, V5 (68.9 cm) whereas shortest was reported in V3 (43.1 cm) at 60 days after transplanting. Maximum number of leaves were found from variety, V5 (61.7) followed by V4 (54.0) whereas minimum from V6 (24.6) followed by V2 (25.0) at 60 days after transplanting (Fig. 1).

Fig. 1. Plant height and number of leaves responses of brinjal varieties at 60 days after transplanting

V1: SAU Mini purple; V2: Anindyo sobuj mini; V3: Franck hall; V4: M Line 4; V5: M Line 5; V6: M Line 6; V7: M Line 7; V8: M Line 8; V9: L line 9 and V10: L line 10
There is no significant variation found in case of number of branch/plant. However, maximum number of branch/plant was found from V4 (3.0) variety, that was statistically similar with all other varieties. Number of flower buds/plant, flowers/plant, fruits/plant and fruit length differed significantly among the brinjal varieties. Maximum number of flower bud/plant was found from V1 (23.7) which was statistically similar with V3 (22.7). However, maximum number of flower/plant was found from V8 (21.4) whereas minimum from V1 (4.8) (Table 1). Maximum number of fruits/plant was counted from V8 (20.6) followed by V1 (17.5). Longest fruit was reported in V4 (11.5 cm) variety which is statistically similar with the V9 (10.9cm) and V10 (10.6cm), however, shortest fruit was found from V1 (5.9cm) (Table 1a).

Fruit diameter (mm), fruit weight (g), yield/plant (kg), yield/plot (kg) and susceptibility to brinjal fruit and shoot borer (BFSB) were showed significant variation among brinjal varieties. Maximum fruit diameter was found from V8 (53.3 mm) which was statistically similar with V5 (52.0 mm). Maximum fruit weight was found from V8 (97.5 g) followed by V3 (93.1 g) whereas minimum from V10 (47.3 g). Maximum yield/plant was recorded from V8 (2.0 kg) followed by V3 (1.6 kg) whereas lowest from V1 and V10 (0.4 kg). Maximum yield/plot was recorded from V8 (23.6 kg) followed by V3 (19.0 kg) while lowest from V2 (4.0 kg) (Table 2). V2 variety showed maximum susceptibility to BFSB (66.3%) while minimum from V8 (24.3%) (Table 1b).

Table 1a. Responses of ten Japanese brinjal varieties to branch, flowers and fruits attributes

<table>
<thead>
<tr>
<th>Variety</th>
<th>Number of branch/plant</th>
<th>Number of bud/plant</th>
<th>Number of flower/plant</th>
<th>Number of fruit/plant</th>
<th>Fruit length (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>2.3a</td>
<td>7.0e</td>
<td>5.7f</td>
<td>5.3f</td>
<td>5.9c</td>
</tr>
<tr>
<td>V2</td>
<td>2.3a</td>
<td>6.0e</td>
<td>4.8g</td>
<td>4.7g</td>
<td>6.8bc</td>
</tr>
<tr>
<td>V3</td>
<td>2.3a</td>
<td>19.7b</td>
<td>18.5b</td>
<td>17.5b</td>
<td>7.3bc</td>
</tr>
<tr>
<td>V4</td>
<td>3.0a</td>
<td>16.0c</td>
<td>11.5d</td>
<td>10.9d</td>
<td>7.8bc</td>
</tr>
<tr>
<td>V5</td>
<td>2.7a</td>
<td>23.7a</td>
<td>15.5c</td>
<td>14.9c</td>
<td>11.5a</td>
</tr>
<tr>
<td>V6</td>
<td>2.7a</td>
<td>6.0e</td>
<td>5.6f</td>
<td>5.6f</td>
<td>6.4bc</td>
</tr>
<tr>
<td>V7</td>
<td>2.7a</td>
<td>10.0d</td>
<td>5.6e</td>
<td>5.4f</td>
<td>8.1b</td>
</tr>
<tr>
<td>V8</td>
<td>2.3a</td>
<td>22.7a</td>
<td>21.4a</td>
<td>20.6a</td>
<td>6.9bc</td>
</tr>
<tr>
<td>V9</td>
<td>2.3a</td>
<td>16.0c</td>
<td>11.5d</td>
<td>11.3d</td>
<td>10.9a</td>
</tr>
<tr>
<td>V10</td>
<td>2.7a</td>
<td>11.0d</td>
<td>8.4e</td>
<td>8.1e</td>
<td>10.6a</td>
</tr>
</tbody>
</table>

CV% 19.7 12.3 2.0 2.9 15.3
LSD 0.05 1.0 2.9 0.4 0.6 2.2

In a column means having similar letter (s) are statistically identical and those having dissimilar letter (s) differ significantly at 0.05 level of probability

Table 1b. Responses of ten Japanese brinjal varieties to fruit and yield attributes

<table>
<thead>
<tr>
<th>Variety</th>
<th>Fruit Diameter (mm)</th>
<th>Fruit weight (g)</th>
<th>Yield/plant (kg)</th>
<th>Yield/plot (kg)</th>
<th>Fruit susceptibility % of BFSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>47.2ab</td>
<td>63.7d</td>
<td>0.4e</td>
<td>4.7f</td>
<td>53.8b</td>
</tr>
<tr>
<td>V2</td>
<td>43.4bc</td>
<td>59.4e</td>
<td>0.6d</td>
<td>4.0g</td>
<td>66.3a</td>
</tr>
<tr>
<td>V3</td>
<td>52.0a</td>
<td>93.1b</td>
<td>1.6b</td>
<td>19.0b</td>
<td>36.4cde</td>
</tr>
<tr>
<td>V4</td>
<td>44.7bc</td>
<td>47.5h</td>
<td>0.5d</td>
<td>6.7d</td>
<td>42.9bcd</td>
</tr>
<tr>
<td>V5</td>
<td>32.3de</td>
<td>55.0f</td>
<td>0.9c</td>
<td>10.4c</td>
<td>46.2bc</td>
</tr>
<tr>
<td>V6</td>
<td>41.8bc</td>
<td>82.4c</td>
<td>0.5d</td>
<td>6.4d</td>
<td>39.9cd</td>
</tr>
<tr>
<td>V7</td>
<td>38.9cd</td>
<td>50.5g</td>
<td>0.5d</td>
<td>5.6e</td>
<td>43.7bcd</td>
</tr>
<tr>
<td>V8</td>
<td>53.3a</td>
<td>97.5a</td>
<td>2.0a</td>
<td>23.6a</td>
<td>24.3f</td>
</tr>
<tr>
<td>V9</td>
<td>27.7e</td>
<td>50.6g</td>
<td>0.6d</td>
<td>6.7d</td>
<td>26.8ef</td>
</tr>
<tr>
<td>V10</td>
<td>26.4e</td>
<td>47.3h</td>
<td>0.4e</td>
<td>5.1ef</td>
<td>33.6def</td>
</tr>
</tbody>
</table>

CV% 10.2 1.2 5.8 3.8 15.7
LSD 0.05 7.1 2.0 0.1 0.6 11.2

In a column means having similar letter (s) are statistically identical and those having dissimilar letter (s) differ significantly at 0.05 level of probability

V1: SAU Mini purple; V2: Anindyo sobuj mini; V3: Franch ball; V4: M Line 4; V5: M Line 5; V6: M Line 6; V7: M Line 7; V8: M Line 8; V9: L line 9 and V10: L line 10

CLUSTER ANALYSIS

Dendogram graphically present the information concerning which genotypes are grouped together at various levels of similarity and dissimilarity. The results of the cluster analysis (Ward’s method) based on varietals characteristics are presented in the Fig. 2; the cluster diagram (also called cluster trees) revealed two major groups. Groups A and B. Group A comprised of single clusters (Cluster I). Cluster I containing 2 varieties (V3 and V4). Group B consist of two clusters (Cluster II and Cluster III). Cluster II contained 5 varieties (V1, V7, V2, V6 and V10) and Cluster III contained 3 varieties (V4, V9 and V8).
Performance evaluation of ten Japanese brinjal (Solanum melongena L.) varieties

Dendogram Using Average Linkage (Between Groups)
Rescaled Distance Cluster Combine

Fig. 2. Dendogram of 10 brinjal cultivars using average linkage (between groups) rescaled distance cluster combine (WARD’s method)

Plate 1. Fruits of ten Japanese brinjal varieties

V_1: SAU Mini purple; V_2: Anindyo sobuj mini; V_3: Franch ball; V_4: M Line 4; V_5: M Line 5; V_6: M Line 6; V_7: M Line 7; V_8: M Line 8; V_9: L line 9 and V_10: L line 10
DISCUSSION

From the result it was found that plant height (cm) varied among the different varieties (Fig. 1). Phenotypic characters of plants varied due to the variation of genotypes in brinjal (Hossain et al. 2002; tomato (Biswa et al. 2014; Nahiyan et al. 2014; Mehraj et al. 2014e); chilli (Mehraj et al. 2015; Mehraj et al. 2014a); Japanese bunch onion (Jamal Uddin et al. 2014c); snake gourd (Haque et al. 2014); bottle gourd (Jamal Uddin et al. 2014d); pumpkin (Jamal Uddin et al. 2014e); asparagus (Jamal Uddin et al. 2014b); strawberry (Hossain et al. 2013; Islam et al. 2013b); gladiolus (Mahasen et al. 2015), gerbera (Mehraj et al. 2013; Jamal Uddin et al. 2014a); chrysanthemum (Jamal Uddin et al. 2015); rose (Shahrin et al. 2015) dendrobiunm (Mehraj et al. 2014b); Heliconia spp (Mehraj et al. 2013a); lisianthus (Jamal Uddin et al. 2013); anthurium (Islam et al. 2013c), bougainvillea (Mehraj et al. 2014c); rice (Sikder et al. 2015; Zaman et al. 2015; Rahman et al. 2014); wheat (Mehraj et al. 2014b); mustard (Mehraj et al. 2014d). Variation in plant height due to the variation of variety was also reported by Hossain et al. (2002) and Rahman et al. (2011). All the plants studied were observed to have different number of leaves and branch/plant. The variation in the plant height, number of leaves and number of branches/plant is an indication of the differences in the growth habit of the plant varieties (Olotuah and Fadare, 2012). But current findings showed that number of branch/plant did not vary significantly among the brinjal varieties (Table 1a) but significant variation was found in number of leaves (Fig. 1) and similar findings was revealed by Hossain et al. (2002). Number of flower buds/plant, number of flowers/plant and number of fruits/plant was also found significant variation among the brinjal varieties (Table 1a). Basar (1999) also observed significant variation for number of flowers per inflorescence, number of fruits/plant weight among 30 brinjal genotypes. Fruit length, fruit diameter (Plate 1) and fruit weight varied significantly among the brinjal varieties (Table 1a and Table 1b). Similar findings were also reported by Basar (1999). Fruit length and diameter ranged from 4.20 to 17.35 cm and 3.23 to 7.73 cm respectively (Singh et al. 1999). As the fruit weight and number of fruits varied significantly among the varieties so that the total yield also varied among varieties (Table 1b). The yield variation in brinjal genotypes was also observed by Tumbe et al. (1992). The infestation percent of BFSB varied from 6.60-46.6%. Choudhary and Saraf (2001) found brinjal fruit damage ranged between 20-25% whereas; Srinivas and Peter (2000) stated that none of the varieties were found completely immune to borer infestation. Surprisingly, Cork (2004) mentioned that fruit damage due to the borer is often more than 80% in northern India and Bangladesh. Varietals resistance against specific insect pest was previously also determined by screening of brinjal varieties (Yousafi et al. 2013; Elanchezhyan et al. 2008; Mahmood et al. 2002; Lit et al. 2002). The results of the above researchers are well comparable with the results of the present study.

Dendogram shows that the varieties in one cluster are mostly identical and have less diversity. From the result of the study it was found that the $V_5$ and $V_8$ were mostly similar performing genotypes and the dendogram showed that they have very low genetic distance. Similarly cluster analysis was also built in dendogram in tomato (Mehraj et al. 2014e), gerbera (Hossain et al. 2015). The main point of the method is to close up the two most similar variables and hereinafter they are handled as one (Turcsanyi 1995). The most similar objects are linked by gradually diminished criteria of similarity (Stanisz 2007). The segmentation of data has a wide application and is very useful in classification of plants (Sava and Popa, 2011). In a breeding program, more the parents are genetically far from each other, more will be the aggressiveness among the offspring (use ref. otherwise would prefer to delete the statement). The main objective of cluster analysis is to determine the extent of genetic affinity or distance of hybrids from each other. It will help breeders to identify suitable parents for developing more successful hybrids. The genetic dissimilarity in 15 cassava clones was evaluated based on seven morpho-agronomic traits aiming to select the most divergent and best in an approach to future hybridizations, the clones were grouped as related to similarity using nearest neighbor (Nick et al. 2008).

CONCLUSION

Lastly it could be mentioned that $V_8$ was the best variety among the varieties used in experiment considering yield related attributes which is closely related to $V_5$ but $V_8$ was less susceptible to brinjal fruit and shoot borer than $V_5$. $V_8$ variety can be recommended for the cultivation in farmer’s field level after several years of repeated trial.

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