COMBINING ABILITY OF QUANTITATIVE CHARACTERS IN BRINJAL
(SOLANUM MELONGENA L.)

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Summary

Combining ability effects were estimated for different characters in a diallel crossing programme comprising 36 crosses developed using 10 parental lines in all possible combinations excluding reciprocals. Parents and crosses differed significantly for gca and sea effects. On the basis of gca and sea variances, most of the characters under study indicated the predominance of additive gene action. The parents, CH-190, and CH-586 were good general combiner for fruit breadth and number of branches per plant. Swarna Shree, CH-586, CH-757 and CH-190 were found best general combiner for most of the yield contributing characters. Crosses namely, CH-757 x CH-792, CH-190 x CH-792 and CH-792 x BL-22 have been found superior on the basis of sea value and per se performance, which may be evaluated for further promotion.

Introduction

Brinjal (Solanum melongena L.) is one of the most important and widely consumed vegetable crops of India, which can be grown throughout the year. This crop exhibits rich genetic diversity for various horticultural traits and has a great scope for its improvement. In brinjal, yield is complex quantitative character and influenced by its contributing traits, i.e., average fruit weight, length, breadth and plant vigour. The selection of parents on the basis of per se performance does not necessarily lead to desirable results. The knowledge of combining ability is prerequisite in any plant breeding programme for varietal improvement and for evolving a hybrid. Hence, attempts have been made to study the general combining ability and specific combining ability effects for quantitative traits in brinjal.

Materials and Methods

The present investigation was conducted during kharif season, 2001-2002 at experimental farm of Horticulture and Agro-Forestry Research Programme, Ranchi. Nine diverse genotypes of brinjal, namely, Swarna Shree (P1), CH-190 (P2), CH-586 (P3), CH-757 (P4), CH-792 (P5), BL-3 (P6), BL-5 (P7), BL-9 (P8) and BL-22 (P9) were crossed in all possible combinations excluding reciprocals. The seeds of 36 F1s along with their 9 parents were sown in the nursery on July 10, 2001. The seedlings were transplanted on August 8, 2001 in randomized block design at a spacing of 60 x 45 cm with three replications. Standard cultural practices were followed to raise the normal crop. Data were recorded on 10 randomly selected plants in each treatment over replications for 8 characters viz., yield (q/ha), average fruit weight (g), fruit length (cm), fruit breadth (cm), fruit firmness (kg/cm²), days to first flowering, number of branches per plant and plant height (cm). Data were averaged and subjected to statistical analysis. The combining ability estimates were calculated according to method 2 and Model I of Griffing (1956).

Results and Discussion

The analysis of variance for gca, sea and their ratios are presented in table-1. The mean square due to general and specific combining ability were highly significant for all the characters indicating the impor-
The parent CH-792 has significant ranking on the basis of the performance of the parents, but such agreement did not for fruit length, while BL-5 was best for fruit firmness. Further, for most of the characters, there was a close agreement between the ranking on the basis of the gca and the per se performance of the parents, but such agreement did not exist for plant height and number of branches. Therefore, both gca effects and per se performance should be taken together for assessing true breeding potential. Similar results were also reported by Ingale and Patil (1997) and Rashid et al. (1988).

Estimates of gca effects are given in Table-3. The numbers of crosses having desirable significant estimates were 11 for yield, 5 for average fruit weight, 9 for fruit length, 11 for fruit breadth, 4 for fruit firmness, 6 for days to first flowering, 2 for number of branches and 5 for plant height. The three best performing crosses showing highest gca effects in order of merit were CH-757 x CH-792, CH-190 x CH-792 and CH-792 x BL-22 for yield, CH-190 x CH-792, SS x CH-757 and CH-190 x CH-757 for average fruit weight, SS x BL-5, SS x BL-9 and CH-586 x BL-22 for fruit length. CH-792 x BL-22, CH-190 x CH-792 and SS x CH-752 for fruit breadth, BL-3 x BL-9, SS x CH-792 and CH-586 x BL-5 for fruit firmness, CH-757 x CH-792, BL-3 x BL-22 and CH-90 x CH-792 for number of branches and SS x BL-9, BL-5 x BL-22 and CH-752 x BL-5 for plant height, whereas highest negative gca effects for days to first flowering were in CH-190 x CH-792, SS x CH-792, SS x BL-9. It is clear from the result obtained that in majority of the crosses which showed the best gca effects, having at least one of the 3 most outstanding parental lines namely, Swarna Shree, CH-190 and CH-757, which have high gca effects for one or more for the yield contributing characters. Such observations also

### Table 1. Analysis of variance (mean square) for combining ability

<table>
<thead>
<tr>
<th>Source</th>
<th>d.f.</th>
<th>Yield</th>
<th>Fruit weight</th>
<th>Plant height</th>
<th>Fruit breadth</th>
<th>Fruit firmness</th>
<th>Days to first flowering</th>
<th>Number of branches</th>
<th>Plant height</th>
</tr>
</thead>
<tbody>
<tr>
<td>gca</td>
<td>8</td>
<td>8591.06**</td>
<td>2600.65**</td>
<td>3.25**</td>
<td>1.54**</td>
<td>1.85**</td>
<td>16.57**</td>
<td>1.04**</td>
<td>274.17**</td>
</tr>
<tr>
<td>sca</td>
<td>36</td>
<td>50462.34**</td>
<td>1934.42**</td>
<td>3.45**</td>
<td>1.71**</td>
<td>1.21**</td>
<td>28.36**</td>
<td>0.64**</td>
<td>150.67**</td>
</tr>
<tr>
<td>Error</td>
<td>88</td>
<td>7038.06</td>
<td>405.21</td>
<td>0.32</td>
<td>0.13</td>
<td>3.26</td>
<td>3.27</td>
<td>0.14</td>
<td>39.64</td>
</tr>
</tbody>
</table>

** Significant at 1% probability level.

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### Table 2. Estimates of general combining ability effects for different characters

<table>
<thead>
<tr>
<th>Character / Parent</th>
<th>Yield</th>
<th>Fruit weight</th>
<th>Fruit length</th>
<th>Fruit breadth</th>
<th>Fruit firmness</th>
<th>Days to first flowering</th>
<th>Number of branches</th>
<th>Plant height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swarna Shree</td>
<td>-177.20**</td>
<td>5.08</td>
<td>0.50**</td>
<td>0.44**</td>
<td>0.22</td>
<td>4.10</td>
<td>0.05</td>
<td>-5.02**</td>
</tr>
<tr>
<td>CH-190</td>
<td>-46.12</td>
<td>-0.05</td>
<td>0.07</td>
<td>0.28**</td>
<td>-0.42*</td>
<td>1.03</td>
<td>0.27*</td>
<td>2.28</td>
</tr>
<tr>
<td>CH-586</td>
<td>70.04*</td>
<td>27.00**</td>
<td>0.46*</td>
<td>0.43**</td>
<td>-0.29</td>
<td>1.27*</td>
<td>0.33*</td>
<td>5.58*</td>
</tr>
<tr>
<td>CH-757</td>
<td>136.69**</td>
<td>20.38**</td>
<td>0.86**</td>
<td>0.37**</td>
<td>0.40*</td>
<td>1.67*</td>
<td>-0.16</td>
<td>-4.72</td>
</tr>
<tr>
<td>CH-792</td>
<td>37.55</td>
<td>-21.68**</td>
<td>-0.49*</td>
<td>-0.60**</td>
<td>1.63**</td>
<td>1.61*</td>
<td>-0.43**</td>
<td>-3.15*</td>
</tr>
<tr>
<td>BL-3</td>
<td>-27.74</td>
<td>-8.07</td>
<td>0.55**</td>
<td>-0.30*</td>
<td>-0.24</td>
<td>0.90</td>
<td>-0.05</td>
<td>-4.70*</td>
</tr>
<tr>
<td>BL-5</td>
<td>-38.32</td>
<td>-8.09</td>
<td>0.25</td>
<td>-0.14</td>
<td>0.60*</td>
<td>0.69</td>
<td>-0.48**</td>
<td>-5.49*</td>
</tr>
<tr>
<td>BL-9</td>
<td>21.46</td>
<td>-16.01</td>
<td>-0.70**</td>
<td>-0.15</td>
<td>-0.37*</td>
<td>0.75</td>
<td>0.01</td>
<td>4.07*</td>
</tr>
<tr>
<td>BL-22</td>
<td>20.63</td>
<td>-4.55</td>
<td>0.36</td>
<td>-0.34**</td>
<td>-0.12</td>
<td>-0.96</td>
<td>0.39**</td>
<td>6.41</td>
</tr>
<tr>
<td>SI (n)</td>
<td>23.84</td>
<td>5.72</td>
<td>0.16</td>
<td>0.10</td>
<td>0.14</td>
<td>0.51</td>
<td>0.10</td>
<td>1.79</td>
</tr>
</tbody>
</table>

**, ** Significant at 5% and 1% probability level, respectively.
For assessing the superiority of a hybrid generally its
se effects and per se performance should be taken into account. In the present study, it was clear that there was a close correspondence between se effects and the per se performance for most of the economic characters. It was also evident that best cross combination for most of the characters generally involved one good and one poor general combiner with high se effects may be due to a complementary type of
gene action which can be fixed to a great extent in the segregating generations, whereas crosses with high
se effects which involved poor x poor combiners, may be utilized for exploitation of hybrid as the non
additive, non fixable genes seems to play a greater role.
Parents like Swarna Shriee, CH-792 and CH-190
in general were proved to be good general combiners
for most of the yield contributing characters. Among
combinations based on the se values and F, per se
performance the hybrid namely, CH-757 x CH-792.
CH-190 x CH-792 and CH-792 x BL-22 has been found superior and these combination can be tested for promotion of F₁ hybrids in brinjal.

References


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