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Abstract

The present research was conducted to study the combining ability and gene action for morphological, yield and its components traits in F1 crosses of wheat using line x tester procedure. Experiment was conducted including thirty genotypes consisting of ten lines, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10 and three testers namely; Sids 12 (T1), Gemmeiza 11 (T2) and Line 137 (T3). Thirty crosses and their parents were evaluated under two irrigation treatments in randomized complete block design with three replications at experimental Research Farm, Faculty of Agriculture Benha Univ. during the winter successive growing seasons 2017/18 and 2018/19. The obtained results could be summarized as follows: highly significant differences were found among irrigation treatment, genotypes and its partitioning lines, testers and line x testers for all the studied traits. Also, interaction between irrigation treatment and mention source of variance were significant for most traits under study. Genetic analysis revealed that the importance of both additive and non-additive components in the inheritance of all traits. The non-additive was more important for most studied traits. The best general combining ability was L8 for earliness, plant height, No. of spikes/plant and grain yield. The crosses T1 x L3, T2 x L1, T2 x L2, T2 x L4, T3 x L4 and T3 x L6 showed highly significant positive Sij effects (desirable) for biological yield/plant and grain yield/plant.

Key words: Wheat, combining ability, drought stress, GCA and SCA.

Introduction

Bread wheat (*Triticum aestivum* L.) is a major food crop in the world. In Egypt, it is used as a stable food grain for urban, rural and bedewing societies and as a major source of straw for animal feeding. However, geometrical increase in the Egyptian population has been a challenge for agricultural scientists. To improve yield potential of wheat there is requirement to have knowledge regarding the nature of combining ability of available parents to be used in the hybridization programme and also about the nature of gene action involved in the expression of economically important quantitative as well as qualitative traits Hassan et al. (2007), Al Saadoon (2017), AL Sadoonet al. (2019) and Al-Tamimi et al (2020). For the development of genetically superior high yielding varieties, identification of superior parents is an important pre-requisite. Earlier research review revealed that both general and specific combining ability were involved for yield and yield components, Chaudhry et al.(1992), Al Saadoon et al. (2017), EL-Hosary et al. (2019) and Al-Tamimi et al (2020). For effective improvement in yield of wheat, one can use combining ability analysis to test the performance of selected parents in different cross combinations and can characterise the nature and magnitude of gene effects in the expression of various yield contributing traits.

Keeping the above in view, the present line × tester analysis was planned to estimate general and specific combining ability effects to identify better parents as well as high cross combinations for further improvement in wheat.

Material and Methods

The present study was carried out at Faculty of Agriculture at moshtohor, Egypt during 2017/18 and 2018/19 seasons, Egypt. In 2017/18 season, line × tester mating design was performed through 10lines in addition to three testers to produce the hybrid seeds of 30 crosses. Parents of the aforementioned genotypes are listed in Table 1.

In 2018/19, the 13 parents along with the 30 F1’S were grown in randomized complete block design with three replications. The sowing date was on 4th Dec. 2018. Two adjacent experiments were conducted. The first experiment was irrigated only once after planting irrigation and the second one was normally irrigated five irrigations. Each genotype was grown in 2 rows of 3m length with inter row and intra row spacing of 30cm and 10cm respectively. To raise a good crop stand all the recommended cultural practices were followed. The recommended cultural practices were applied at the proper time. Data were recorded on a sample of 10 plants/replication in each genotypes whereas for days to 50% flowering (day), plant height (cm), number of spikes per plant, number of grains per spike, 1000-grain weight (g) and grain yield per plant (g). Data for the characters depicting significant difference were further analyzed for line × tester according to Singh and Chaudhry (1979).
Table 1. The name and pedigrees of the parental genotypes.

<table>
<thead>
<tr>
<th>NO.</th>
<th>Genotype</th>
<th>Pedigree</th>
<th>Origin</th>
</tr>
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<tbody>
<tr>
<td>L1</td>
<td>M101</td>
<td>MILAN \S71101\OAPYMex</td>
<td>CIMMYT</td>
</tr>
<tr>
<td>L2</td>
<td>M102</td>
<td>MILAN \S7102\OAPYMex</td>
<td>CIMMYT</td>
</tr>
<tr>
<td>L3</td>
<td>M103</td>
<td>MILAN \S7103\OAPYMex</td>
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</tr>
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<td>L4</td>
<td>M104</td>
<td>MILAN \S7104\OAPYMex</td>
<td>CIMMYT</td>
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<td>L5</td>
<td>M105</td>
<td>MILAN \S7105\OAPYMex</td>
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<td>L6</td>
<td>M106</td>
<td>MILAN \S7106\OAPYMex</td>
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<td>L7</td>
<td>M107</td>
<td>MILAN \S7107\OAPYMex</td>
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<td>L8</td>
<td>M108</td>
<td>MILAN \S7108\OAPYMex</td>
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</tr>
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<td>L9</td>
<td>M109</td>
<td>MILAN \S7109\OAPYMex</td>
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</tr>
<tr>
<td>L10</td>
<td>M110</td>
<td>MILAN \S7110\OAPYMex</td>
<td>CIMMYT</td>
</tr>
<tr>
<td>T1</td>
<td>Sids 12</td>
<td>BUC/7C/ALD/S/MAYA74/ON//1160.147/3/BB/GLL 4*/SXS67096-4SD-1SD-1SD 0SD 4*/CHAT<em>S</em>/6/MAYA/VUL//CMH74A.630/ 4*/SXYS7096-4SD-1SD-1SD 0SD</td>
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</tr>
<tr>
<td>T3</td>
<td>M L 1137</td>
<td>MILAN \S7137\OAPYMex</td>
<td>Egypt</td>
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Results and Discussion

Analysis of variance
The analysis of variance of ordinary and line x testers mating design for all the studied traits are presented in Table (2).

Analysis of variance revealed highly significant for crosses and their partitions; lines, testers and line x testers for all the studied traits except thousand grain weight for line, tester and line x tester in both and across environments and tester for plant height in drought environment, indicating the wide diversity among the genotypes, which is considered adequate for further biometrical assessment. These results are in agreement with those of Abd El-Aty (2002), Abd El-Atyand Katta (2002), Nouret al. (2011), Kumar et al. (2015) and Al-Tamimi et al. (2020).

Genetic components
Knowledge of gene action helps in the selection of parents for use in the hybridization programs, also in the choice of appropriate breeding procedure for the genetic improvement quantitave characters.
The estimates of genetic parameters were calculated, for all the studied traits as presented in Table (2). The results showed that the non-additive genetic variance were larger than the additive genetic variance σ^GCA^ SC A for all the studied traits, suggesting greater importance of non-additive genetic variance in the inheritance of these traits. The GCA variance were lower than SCA variance in terms of all traits evaluated in the research in contrast to Titan et al. (2012). They used 6 wheat lines and seven testers and they tested 42 F1 combinations for two seasons. Also, Sharma et al. (2006) stated that σ^GCA^ variance was of greater importance than σ^SCA^ for some traits. The difference in the results reported by researchers may be attributed to differences of parental materials used hybridization and to genotype x environments. The ratio σ^GCA^ σ^SCA^ varies depending on the allele frequencies between parental populations (Reif et al., 2007; Longinet al., 2013). The lines selected from different gene pools had favorable σ^GCA^ σ^SCA^ ratio because of their high GCA effects (Labateet al., 1997). In this study, low ratios of O^GCA^ O^SCA^, O^A^ O^D^ and These results showed that σ^GCA^ σ^SCA^ portion was lower than one and (O^A^ O^D^) portion, which is an indicator of dominance degree, lower than one (Table 2). Hence, it can be seen that non-additive genetic effects are controlling the inheritance of studied traits. Fellahie et al. (2013) and EL-Hosary and Abdelwahed (2015) reported the importance of non-additive gene action for the plant height, number of fertile tillers, thousand kernel weight and kernel yield. They recommended that selection of superior plants should be postponed to later generations due to preponderance of non-additive type of gene actions for all studied traits. Similar results of predominance of non-additive gene action for all studied traits have been reported by Verma et al. (2007) for wheat. The efficiency of the selection is related with the size of narrow sense heritability in the segregating populations. The heritability degrees were found very low for the traits studied in the research (Table 2). This situation showed that the additive variance is very low in this population and the selection must be applied in the further generations.

This findings proved that in the present study, both non-additive and additive components are important expression of the studied traits. Similar results were previously reported by Khalifa et al. (1998), Abd El-

Aty (2000), Abd El-Aty and Katta (2002), EL-

Hosary and Abdelwahed (2015) and Al-Tamimi et al. (2020).

Table 2. Analysis of variance for various agronomic traits in line x tester analysis in wheat.

<table>
<thead>
<tr>
<th>S.O.V.</th>
<th>df</th>
<th>Days to heading (days)</th>
<th>Plant height (cm)</th>
<th>No. of spikes/plant</th>
<th>No. of grains/spike</th>
<th>1000-Grain weight (g)</th>
<th>Biological yield/plant (g)</th>
<th>Grain yield/plot (g)</th>
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<td>1.88</td>
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<td>2.63</td>
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<td>246.90**</td>
<td>1.16</td>
<td>7994.06**</td>
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<td>47.54**</td>
<td>49.99**</td>
<td>191.17**</td>
<td>0.80</td>
<td>5250.96**</td>
<td>426.54**</td>
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<td>*</td>
<td>47.56**</td>
<td>*</td>
<td>1.54</td>
<td>4291.30**</td>
<td>369.38**</td>
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<td>78.98**</td>
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<td>184.85**</td>
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<td>9777.03**</td>
<td>339.35**</td>
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<td>0.78</td>
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<td>0.00</td>
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<td>Irrigation (I)</td>
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<td>26.45**</td>
<td>*</td>
<td>32688.11**</td>
<td>*</td>
<td>6.42**</td>
<td>*</td>
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<td>Rep/I</td>
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<td>1.47</td>
<td>14.25**</td>
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<td>*</td>
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<td>3687.41**</td>
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<td>2.07</td>
<td>755.49**</td>
<td>357.54**</td>
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<td>18</td>
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<td>41.69**</td>
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<td>622.66**</td>
<td>0.89</td>
<td>4550.97**</td>
<td>261.03**</td>
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<td>57.20**</td>
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<td>*</td>
<td>0.76</td>
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<td>*</td>
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<td>85.55**</td>
<td>267.60**</td>
<td>*</td>
<td>0.51</td>
<td>*</td>
<td>135.78**</td>
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<td>L x T x I</td>
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<td>0.59</td>
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<td>-139.44</td>
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<tr>
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<td>0.38</td>
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<td>0.02</td>
<td>237.55</td>
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<td>0.14</td>
<td>1039.88</td>
<td>60.35</td>
<td></td>
</tr>
</tbody>
</table>

*and ** significant at 0.05 and 0.01 respectively
Mean performance of genotypes

Mean performance values of the F1 crosses for all the studied traits are presented in Table (3). The crosses T1 x L2, T1 x L3, T1 x L9, T2 x L4, T2 x L8, T2 x L9 and T3 x L6 were the earliest flowering date. As the regard to plant height, four of the F1 top crosses T1 x L5, T1 x L8, T2 x L5 and T2 x L6 were taller than their parental means. The cross T2 x L8 had the highest values for No. of spikes/plant. The parental combination T1 x L5 had higher No. of grains/spike.

The cross T3 x L1 had superior in 1000-grain weight. Concerning the grain yield/plant, the cross T2 x L1 were higher in the grain yield/plant. The crosses were higher in the grain yield/plant, where the heaviest cross for biological yield/plant was detected by the cross T1 x L3. These results were coincident with these obtained by Khalifa et al. (1998), Abd El-Aty and Katta (2002), Nour et al. (2011), Kumar et al. (2015) and Rajput and Kandalkare (2018).

Table 3. Mean performance of hybrids (line x tester) for all studied traits.

<table>
<thead>
<tr>
<th>Cross</th>
<th>Days to heading (Days)</th>
<th>Plant height (cm)</th>
<th>No. of spikes/plant</th>
<th>No. of grain spike</th>
<th>1000-Grain weight (g)</th>
<th>biological yield/plant (g)</th>
<th>grain yield/plant (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 X L1</td>
<td>102.33</td>
<td>102.83</td>
<td>25.01</td>
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<td>46.67</td>
<td>237.33</td>
<td>50.83</td>
</tr>
<tr>
<td>T1 X L2</td>
<td>99.83</td>
<td>108.17</td>
<td>17.46</td>
<td>64.17</td>
<td>51.67</td>
<td>292.67</td>
<td>46.33</td>
</tr>
<tr>
<td>T1 X L3</td>
<td>104.83</td>
<td>111.83</td>
<td>25.06</td>
<td>51.50</td>
<td>56.67</td>
<td>368.17</td>
<td>68.83</td>
</tr>
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<td>T1 X L4</td>
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<td>68.17</td>
<td>50.00</td>
<td>231.33</td>
<td>42.13</td>
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<td>53.33</td>
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<td>46.67</td>
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<td>48.33</td>
<td>306.33</td>
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<tr>
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<td>104.83</td>
<td>27.85</td>
<td>67.50</td>
<td>48.33</td>
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<td>102.83</td>
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<td>67.00</td>
<td>55.00</td>
<td>262.83</td>
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</tr>
<tr>
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<td>60.33</td>
<td>41.67</td>
<td>245.50</td>
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<tr>
<td>T2 X L7</td>
<td>100.33</td>
<td>108.00</td>
<td>20.28</td>
<td>67.17</td>
<td>40.00</td>
<td>248.50</td>
<td>51.50</td>
</tr>
<tr>
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<td>100.83</td>
<td>108.00</td>
<td>39.44</td>
<td>51.50</td>
<td>50.00</td>
<td>286.50</td>
<td>53.50</td>
</tr>
<tr>
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<td>70.33</td>
<td>55.00</td>
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<td>257.00</td>
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<td>59.00</td>
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<td>23.25</td>
<td>70.17</td>
<td>55.00</td>
<td>252.83</td>
<td>65.17</td>
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<tr>
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<td>109.33</td>
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<td>33.33</td>
<td>310.33</td>
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<td>263.83</td>
<td>55.83</td>
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<td>106.00</td>
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<td>73.83</td>
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<td>267.67</td>
<td>56.00</td>
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<td>73.50</td>
<td>45.00</td>
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<td>62.33</td>
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<tr>
<td>T3 X L9</td>
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<td>22.49</td>
<td>49.67</td>
<td>46.67</td>
<td>248.67</td>
<td>51.17</td>
</tr>
<tr>
<td>T3 X L10</td>
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<td>106.67</td>
<td>24.04</td>
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<td>53.33</td>
<td>307.50</td>
<td>64.17</td>
</tr>
<tr>
<td>LSD 5%</td>
<td>2.05</td>
<td>2.73</td>
<td>1.38</td>
<td>1.02</td>
<td>46.67</td>
<td>2.77</td>
<td>1.78</td>
</tr>
<tr>
<td>LSD 1%</td>
<td>2.70</td>
<td>3.59</td>
<td>1.81</td>
<td>1.34</td>
<td>51.67</td>
<td>3.65</td>
<td>2.34</td>
</tr>
</tbody>
</table>

Combining ability

General combining ability effects (GCA (g'i)).

The estimate of general combining ability for parents (lines and testers) are presented in Table (4).

The result illustrated that: the tester 1 was a good combiner for No of grains/ spike and biological yield/plant. T2 showed good combiner for plant height. T3 was a good combiner for plant height, 1000-grain weight and grain yield/plant.
Table 4. Estimates of general combining ability effects of parents for studied traits.

<table>
<thead>
<tr>
<th>Parent/Line</th>
<th>Days to heading (days)</th>
<th>Plant height (cm)</th>
<th>No. of spikes/plant</th>
<th>No. of grains/spike</th>
<th>1000-grain weight (g)</th>
<th>biological yield/plant (g)</th>
<th>Grain yield/plant (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tester</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>-0.04</td>
<td>0.22</td>
<td>-0.20</td>
<td>3.29**</td>
<td>0.07</td>
<td>3.34**</td>
<td>-1.62**</td>
</tr>
<tr>
<td>2</td>
<td>-0.11</td>
<td>-1.43**</td>
<td>0.94**</td>
<td>-1.78**</td>
<td>-0.21**</td>
<td>-3.72**</td>
<td>-1.19**</td>
</tr>
<tr>
<td>3</td>
<td>0.16</td>
<td>1.20**</td>
<td>-0.73**</td>
<td>-1.51**</td>
<td>0.14*</td>
<td>0.38</td>
<td>2.81**</td>
</tr>
<tr>
<td>L.S.D. (gi) 5%</td>
<td>0.32</td>
<td>0.43</td>
<td>0.22</td>
<td>0.16</td>
<td>0.14</td>
<td>0.44</td>
<td>0.28</td>
</tr>
<tr>
<td>L.S.D. (gi) 1%</td>
<td>0.43</td>
<td>0.57</td>
<td>0.29</td>
<td>0.21</td>
<td>0.18</td>
<td>0.58</td>
<td>0.37</td>
</tr>
<tr>
<td>L.S.D. (gi-gi) 5%</td>
<td>0.53</td>
<td>0.71</td>
<td>0.36</td>
<td>0.26</td>
<td>0.22</td>
<td>0.72</td>
<td>0.46</td>
</tr>
<tr>
<td>L.S.D. (gi-gi) 1%</td>
<td>0.70</td>
<td>0.93</td>
<td>0.47</td>
<td>0.35</td>
<td>0.29</td>
<td>0.94</td>
<td>0.60</td>
</tr>
<tr>
<td>Line</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.66</td>
<td>-1.09</td>
<td>3.07**</td>
<td>-7.49**</td>
<td>0.13</td>
<td>15.64**</td>
<td>6.00**</td>
</tr>
<tr>
<td>2</td>
<td>0.49</td>
<td>1.24*</td>
<td>-0.46</td>
<td>1.95**</td>
<td>0.19</td>
<td>7.53**</td>
<td>0.34</td>
</tr>
<tr>
<td>3</td>
<td>1.11**</td>
<td>2.13**</td>
<td>-1.98**</td>
<td>-4.72**</td>
<td>0.36*</td>
<td>22.70**</td>
<td>4.00**</td>
</tr>
<tr>
<td>4</td>
<td>-0.23</td>
<td>2.91**</td>
<td>-0.74*</td>
<td>-6.72**</td>
<td>-0.20</td>
<td>0.42</td>
<td>-2.45**</td>
</tr>
<tr>
<td>5</td>
<td>-0.67</td>
<td>-2.31**</td>
<td>-2.42**</td>
<td>35.45**</td>
<td>0.02</td>
<td>18.08**</td>
<td>2.00**</td>
</tr>
<tr>
<td>6</td>
<td>1.05*</td>
<td>-1.03</td>
<td>1.79**</td>
<td>-8.05**</td>
<td>-0.20</td>
<td>22.08**</td>
<td>-4.94**</td>
</tr>
<tr>
<td>7</td>
<td>-0.01</td>
<td>-0.09</td>
<td>-2.59**</td>
<td>1.23**</td>
<td>-0.48**</td>
<td>-0.63</td>
<td>-5.08**</td>
</tr>
<tr>
<td>8</td>
<td>-0.84*</td>
<td>1.97**</td>
<td>3.77**</td>
<td>-3.55**</td>
<td>-0.26</td>
<td>-1.08</td>
<td>1.06**</td>
</tr>
<tr>
<td>9</td>
<td>-1.39**</td>
<td>-2.26**</td>
<td>0.81**</td>
<td>-3.16**</td>
<td>0.30</td>
<td>-12.41**</td>
<td>-4.11**</td>
</tr>
<tr>
<td>10</td>
<td>-0.17</td>
<td>-1.48**</td>
<td>-1.28**</td>
<td>-4.94**</td>
<td>0.13</td>
<td>7.98**</td>
<td>3.18**</td>
</tr>
<tr>
<td>L.S.D. (gi) 5%</td>
<td>0.84</td>
<td>1.12</td>
<td>0.56</td>
<td>0.42</td>
<td>0.35</td>
<td>1.13</td>
<td>0.73</td>
</tr>
<tr>
<td>L.S.D. (gi) 1%</td>
<td>1.10</td>
<td>1.47</td>
<td>0.74</td>
<td>0.55</td>
<td>0.46</td>
<td>1.49</td>
<td>0.96</td>
</tr>
<tr>
<td>L.S.D. (gi-gi) 5%</td>
<td>1.19</td>
<td>1.58</td>
<td>0.80</td>
<td>0.59</td>
<td>0.50</td>
<td>1.60</td>
<td>1.03</td>
</tr>
<tr>
<td>L.S.D. (gi-gi) 1%</td>
<td>1.56</td>
<td>2.07</td>
<td>1.05</td>
<td>0.78</td>
<td>0.66</td>
<td>2.10</td>
<td>1.35</td>
</tr>
</tbody>
</table>

*and ** significant at 0.05 and 0.01 respectively

Also, the results revealed that two parental lines; L8, and L9 showed significant negative (gi) effects (desirable) for days to heading is essentially a prerequisite in breeding program of a crop.

Regarding to plant height, dwarf plants are more lodging resistant while tall plants are preferred for straw purpose thus preference depends upon the breeding objective. Therefore, the parental lines L2, L3, L4, and L8 can be considered as good general combiner for tallness as they showed highly significant positive (gi) effects, while, L5, L9 and L10 exhibited good combiner for dwarfness as they showed highly significant negative GCA (gi).

For No. of spikes/plant, the parental lines L1, L6, L4 and L8 showed highly significant positive (gi) effects.

With respect to No. of grains/spike parental line L2, showed highly significant positive GCA effects, these parents considered as good combiner for this trait. No. of grains/spike is an important yield contributing trait.

For 1000-grains weight, the parental line; L3 showed highly significant positive (gi) effects. 1000 grain weight is an important direct selection criterion for the selection of grain yield, thus significant positive GCA values considered as good general combining ability effects.

Regarding biological yield/plant and grain yield/plant; three parental lines L1, L6 and L9 exhibited highly significant positive (gi) effects. These results are in agreement with the earlier studies carried out by Abd El-Aty and Katta (2002), Akbar et al. (2009), Abdel Nour et al. (2011), Attia et al. (2014), Kumar et al. (2015), Abro et al. (2016) and Tabassum and parasad (2017).

Specific combining ability

The results of specific combining ability effects of top crosses for all the studied traits are presented in Table (5).

Three crosses, T1 x L2, T1 x L6, and T3 x L3 showed significant negative (desirable) Sij effects for days to heading, which indicated that one or more of these combinations could be helpful for selecting early maturity wheat lines.

For plant height, five crosses T1 x L3, T1 x L8, T2 x L7, T2 x L9 and T3 x L6 showed significant positive Sij effects (tall plant), it could be a good combiner for straw production.

For No. of spikes/plant, the top crosses; T1 x L3, T1 x L6, T1 x L7, T1 x L9, T2 x L1, T2 x L2, T2 x L4, T2 x L6, T3 x L2, T3 x L6 and T3 x L10 showed significant positive (desirable) SCA (Sij). These crosses can be used for increasing No. of tillers/plant.
Regarding No. of grains/spike, the crosses: T1 x L1, T1 x L3, T1 x L5, T1 x L8, T2 x L4, T1 x L3, T2 x L2, T2 x L6, T3 x L7, T2 x L9, T3 x L1, T1 x L2, T3 x L3, T1 x L8, T3 x L6 and T3 x L10 exhibited significant positive Sij effects.

Thirteen and fourteen crosses exhibited positive Sij effects for biological yield/ plant and grain yield/plant, respectively. However, the crosses T1 x L3, T2 x L1, T2 x L3, T2 x L4, T1 x L9 and T3 x L8 showed highly significant positive Sij effects (desirable) for the mention traits, they consider the best combiner for both traits.

Table 5. Estimates of specific combining ability effects of parents for studied traits.

<table>
<thead>
<tr>
<th>Cross</th>
<th>Days to heading</th>
<th>Plant height</th>
<th>No. of spikes/plant</th>
<th>No. of grains/spike</th>
<th>1000-Grain weight</th>
<th>biological yield/plant</th>
<th>Grain yield/plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 X L1</td>
<td>-0.18</td>
<td>-2.45*</td>
<td>-1.17*</td>
<td>1.04**</td>
<td>-0.52</td>
<td>-54.68**</td>
<td>-9.16**</td>
</tr>
<tr>
<td>T1X2</td>
<td>-2.51**</td>
<td>0.56</td>
<td>-5.19**</td>
<td>-6.40**</td>
<td>-0.07</td>
<td>8.77**</td>
<td>-7.99**</td>
</tr>
<tr>
<td>T1X3</td>
<td>1.88*</td>
<td>3.33**</td>
<td>3.93**</td>
<td>-12.40**</td>
<td>0.26</td>
<td>69.10**</td>
<td>10.84**</td>
</tr>
<tr>
<td>T1X4</td>
<td>1.04</td>
<td>0.72</td>
<td>-3.58**</td>
<td>6.27**</td>
<td>0.15</td>
<td>45.46**</td>
<td>-9.40**</td>
</tr>
<tr>
<td>T1X5</td>
<td>-0.01</td>
<td>0.28</td>
<td>-0.73</td>
<td>33.60**</td>
<td>0.26</td>
<td>-5.46**</td>
<td>5.84**</td>
</tr>
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<td>4.39**</td>
<td>-0.23</td>
<td>-0.18</td>
<td>10.79**</td>
<td>5.12**</td>
</tr>
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<td>1.82*</td>
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<td>1.50**</td>
<td>-11.18**</td>
<td>-0.07</td>
<td>25.27**</td>
<td>-4.81**</td>
</tr>
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<td>-8.67**</td>
<td>-4.73**</td>
<td>-0.13</td>
<td>8.96**</td>
<td>-0.88</td>
</tr>
<tr>
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<td>-0.28</td>
<td>9.45**</td>
<td>1.04**</td>
<td>0.32</td>
<td>28.04**</td>
<td>11.95**</td>
</tr>
<tr>
<td>T1X10</td>
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<td>-0.56</td>
<td>0.08</td>
<td>-7.01**</td>
<td>-0.02</td>
<td>5.84**</td>
<td>-1.50**</td>
</tr>
<tr>
<td>T2 X L1</td>
<td>-0.44</td>
<td>0.87</td>
<td>3.71**</td>
<td>-2.39**</td>
<td>-0.07</td>
<td>21.39**</td>
<td>14.58**</td>
</tr>
<tr>
<td>T2X2</td>
<td>1.06</td>
<td>-1.12</td>
<td>4.06**</td>
<td>2.00**</td>
<td>-0.12</td>
<td>19.33**</td>
<td>1.58**</td>
</tr>
<tr>
<td>T2X3</td>
<td>-0.06</td>
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<td>-0.83</td>
<td>8.17**</td>
<td>0.38</td>
<td>-29.17**</td>
<td>-2.26**</td>
</tr>
<tr>
<td>T2X4</td>
<td>-0.39</td>
<td>-1.30</td>
<td>3.08**</td>
<td>-2.50**</td>
<td>-0.57</td>
<td>8.94**</td>
<td>2.87**</td>
</tr>
<tr>
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</tr>
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<td>-8.92**</td>
<td>4.83**</td>
<td>-0.40</td>
<td>-1.72</td>
<td>-7.48**</td>
</tr>
<tr>
<td>T2X7</td>
<td>-1.44</td>
<td>3.37**</td>
<td>-1.37**</td>
<td>2.39**</td>
<td>-0.29</td>
<td>-20.17**</td>
<td>2.16**</td>
</tr>
<tr>
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<td>11.42**</td>
<td>-8.50**</td>
<td>0.49</td>
<td>18.28**</td>
<td>-1.98**</td>
</tr>
<tr>
<td>T2X9</td>
<td>1.44</td>
<td>2.04*</td>
<td>-8.56**</td>
<td>9.94**</td>
<td>0.43</td>
<td>-15.72**</td>
<td>-8.81**</td>
</tr>
<tr>
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<td>-2.83**</td>
<td>0.72</td>
<td>-0.07</td>
<td>20.28**</td>
<td>-1.07</td>
</tr>
<tr>
<td>T3 X L1</td>
<td>0.62</td>
<td>1.57</td>
<td>-2.54**</td>
<td>1.34**</td>
<td>0.58</td>
<td>33.29**</td>
<td>-5.42**</td>
</tr>
<tr>
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<td>1.46*</td>
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<td>1.13*</td>
<td>4.40**</td>
<td>0.19</td>
<td>-28.10**</td>
<td>6.41**</td>
</tr>
<tr>
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<td>-0.15</td>
<td>-3.11**</td>
<td>4.23**</td>
<td>-0.64*</td>
<td>-39.93**</td>
<td>-8.59**</td>
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<td>0.50</td>
<td>-3.77**</td>
<td>0.42</td>
<td>36.51**</td>
<td>6.54**</td>
</tr>
<tr>
<td>T3X5</td>
<td>0.29</td>
<td>-2.04*</td>
<td>0.50</td>
<td>-18.93**</td>
<td>-0.47</td>
<td>-13.66**</td>
<td>-6.25**</td>
</tr>
<tr>
<td>T3X6</td>
<td>0.40</td>
<td>7.18**</td>
<td>4.53**</td>
<td>-4.60**</td>
<td>0.58</td>
<td>12.51**</td>
<td>2.36**</td>
</tr>
<tr>
<td>T3X7</td>
<td>-0.38</td>
<td>-1.26</td>
<td>-0.13</td>
<td>8.79**</td>
<td>0.36</td>
<td>-5.10**</td>
<td>2.66**</td>
</tr>
<tr>
<td>T3X8</td>
<td>0.29</td>
<td>-5.48**</td>
<td>-2.75**</td>
<td>13.23**</td>
<td>-0.36</td>
<td>-9.32**</td>
<td>2.86**</td>
</tr>
<tr>
<td>T3X9</td>
<td>0.01</td>
<td>-1.76</td>
<td>-0.89</td>
<td>-10.99**</td>
<td>-0.75*</td>
<td>-12.32**</td>
<td>-3.14**</td>
</tr>
<tr>
<td>T3X10</td>
<td>-0.21</td>
<td>0.80</td>
<td>2.75**</td>
<td>6.29**</td>
<td>0.08</td>
<td>26.12**</td>
<td>2.57**</td>
</tr>
</tbody>
</table>

L.S.D. (Sij) 5%  1.45  1.93  0.98  0.72  0.61  1.96  1.26
L.S.D. (Sij) 1%  1.91  2.54  1.28  0.95  0.80  2.58  1.65
L.S.D. (Sij-Skl) 5%  2.05  2.73  1.38  1.02  0.87  2.77  1.78

L.S.D. (Sij-Skl) 1%  2.70  3.59  1.81  1.34  1.14  3.65  2.34

* and ** significant refer to the level of significant at 0.05 and 0.01 respectively

References


تقدير القدرة على التالف و الفعل الجينى باستخدام تكنيك السلالة X الكشاف في قمح الخبز

نسمه سالم حسين, محمود الزعبلاوى البدوى , احمد على الحصرى و صديق عبد العزيز صديق محيسن

قسم المحاصيل – كلية الزراعه - جامعة بنها

اقيمت التجربة لدراسة القدرة على التالف و الفعل الجيني لبعض صفات التلاقيع و التلوث و مكوناته و أيضا التفاعل مع معاملات الري. اجري تقييم 30 هجينة بين 3 كشافات و 10 سلالات مستورده حيث تم اتباع تكنيك السلالة X الكشاف. تم تقسيم الهرج في تصميم قطاعات كاملة العشوائية و ذلك تحت معاملتين رئي مختلفتين (ري عادي و جفاف). ، كان متوسط القيمة لمعاملات الري و التراكمات الوراثية و تجزئتها (سلالة – كشاف – سلالة X كشاف) معنوى لمعدوم الصفات تحت الدراسة. كان نمذج القدرة العامة و الخاصة على التالف معنوى في جميع الصفات تحت الدراسة و الجزء الغير مضبوط يتحكم في اظهار معدوم الصفات. كان التفاعل بين معاملات الري و جميع مصادر القيمة معنوى في معظم الصفات تحت الدراسة. كانت السلالة رقم 8 أكثر قدرا على التالف للتيكو و طول نبات و عدد السنابل/نبات و محصول حبوب الزيت. اظهرت الهرج T3 X L و T2 x L4 T3 x L4, T2 x L2، T2 x L1، T1 x L3 القدرة خاصة على التالف معنوية و موجبة لصفة محصول الزيت البيولوجي و محصول حبوب الزيت.