GENETIC PREDICTION OF STRIPE RUST RESISTANCE THROUGH CROSSING ANZA A* TO SIX EGYPTIAN WHEAT CULTIVARS

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ABSTRACT

Anza A* was crossed with 6 Egyptian wheat cultivars (Triticum aestivum, L.). These cultivars, F1, and F2 were tested under greenhouse conditions at seedling stage against pathotype (race) 230E18 of Puccinia striformis. The cultivars and F1 possessed a susceptible (S) phenotype. The F2 populations were segregated into two gene pairs. The dominance trend direction of susceptibility. The resistance genes were recessive. On the other hand, at adult stage under field conditions against races mixture of the pathogen, Anza A* possessed (R) phenotype, the F1 showed resistance of each all crosses. The F2 populations were segregated with 4 crosses (2 and 2) fitted the expected ratios 15 (R): 1 (S) and 3 (R): 1 (S). The other two crosses i.e., Anza A*/Giza 168 and Anza A*/ Sakha94 appeared no segregated and dominance of resistance. The cultivars Giza 168 and Sakha94 may have the adult plant resistance gene Yr A* under filed conditions. These findings confirmed that this gene is an effective under the Egyptian environmental conditions. Results obtained showed that partial stripe rust resistance in the tested wheat cultivars was controlled by one or two gene pairs in most cases at seedling and adult stages. These results indicated that the selection for partial resistance materials in the early generations was possible while delaying it to late ones is more effective, due to the important role of dominance effect in the expression of this trait.

INTRODUCTION

Striped or yellow rust caused by Puccinia striformis Westend f. sp. tritici lead to yield losses in many of the worlds’ important wheat production areas (Zwer and Qualset 1991). The pathogen causes damaging to susceptible autumn-sown spring wheat (Triticum aestivum, L.) varieties. In Egypt, a Mediterranean-type climate with cool and moisture winter and spring when the crop is in the stem elongation to heading phases and pathogen can likely cause an epiphytotic. Difference in seedling and adult-plant reactions for stripe rust were noted early in some varieties by (Robbelen & Sharp 1978). These varieties were susceptible as seedling and resistant in the adult plant stage. Allan et al.,(1966) and Johnson & Law (1975) recorded similar phenomena. However, lines and varieties expressing intermediate infection type as seedling were resistant to the same pathogen and isolate in the adult stage. The adult plant resistance to stripe rust is controlled by at least two or more genes (Wallwork and Johnson 1984; Barianna and McIntosh 1995; Afshari 2000; Gosal 2000 and Singh et al., 2000.)
MATERIALS AND METHODS

This investigation was carried out in Wheat Disease Research Division under greenhouse and field conditions at Sakha Agricultural Research Station.

Host: six Egyptian wheat cultivars i.e., Gemmeiza7, Giza168, Sakha94, Sids1, Sakha8 and Sakha69 exhibited different levels of resistance or susceptibility, there were crossed with variety Anza (YrA⁺) exhibited high resistance in its reaction to stripe rust. They were chosen as parental materials in the present work. These parents were sown in 2004/2005 growing season in seven rows each. The crosses among Anza YrA⁺ and six wheat cultivars, (Anza (YrA⁺ was used as male parent) were carried to produce the hybrid seeds. Any doubtful of F₁ plants were discarded and the others were harvested separately. Part of the F₁ seeds was grown at the following season (2005/2006) in row 3m. long and 30 cm apart and spaced 30 cm., in order to allow the production of F₂ seeds. A comparative experiment was carried out in 2006/2007 growing season in a randomized complete block design with three replicates. Each replicate contained one row for each parent and F₁ as well as 13 rows for each F₂. This performance was conducted to create uniform environmental conditions for disease development. The rows were 2m long, 30 cm apart. Seeds were sown at 10 cm. spacing within rows. Therefore, each row contained 20 plants. A mixture of the highly susceptible wheat cultivars i.e., Morocco, Triticum spelta Saharensis and Little club were sown around the experiment as belt spreader to disseminate the urediniospores of the pathogen. All regular cultural practices of wheat were applied during the three growing seasons.

A- Seedling stage test (under greenhouse conditions)

Three replicates, each one included one pot for each of the two parents and F₁’s as well as 13 pots for F₂’s were sown, with 20 seed each. These materials were tested in a room condition in the greenhouse with daylight rhythm of 16/8 hours. Light intensity was approx. 7500 lux and temperature of 10-15 °C. the plants were ready to be inoculated at 8 days of sowing. The plants were inoculated following the method of Tervet and Cassel (1951) and Stakman et al., (1962), in which, plants were dusted with mixture of spores and Talcum powder at the rate 1:20 (w:w) or tightly rubbing method. Inoculated plants were kept in an incubator apparatus for 24 hours at 90% relative humidity and 10 °C and transferred to the growth chamber for 14 days according the method adopted by Stubbr (1985).

Host reaction type: infection type was rated on the scale (0-9) adopted by McNeal et al., (1971) as used in the seedling studies, where, 0= immune, 1 to 3 were classified as resistant, 4 to 5 were intermediate and 7 to 9 were susceptible. These infection types were grouped into two classes in the seedling and adult studies: 0 to 6 was considered as resistant and 7 to 9 were susceptible.

B- Adult stage test (under field conditions)

The spreader plants were moistened and dusted using urediniospores and Talcum powder at the rate 1:20 (w:w). all materials were inoculated at booting stage according to the methods adapted by Tervet and
Cassel (1951). Rust severity (%) was recorded on adult plants according to the method adopted by modified Cobb scale (Peterson et al., 1948) and the host response was evaluated following scale described by Roelfs et al., (1992).

Stripe rust uredia first appeared on 25 January 2007. Individual plants were rated before the early-heading stage. Resistant plants were marked with blue tape and susceptible ones by red tape according to disease severity into each class. The number of plants rated ranged from 190 to 260 per F₂ plant populations.

C- Inheritance study

To study the inheritance of stripe rust resistance, the F₂ plant populations were divided into 12 categories depending upon their percentage of rust severity under field conditions. These classes were 0, 0%, 10R, 20R, 20MR, 20MS, 10MS, 10S, 20S, 30S, 40S and 50S. plants of the first four classes were pooled together and considered as the resistant phenotypes. However, plants in the other classes were considered as susceptible ones. Frequency distribution values were recorded for parents, F₁ and F₂ populations in terms of infection type in all the crosses at seedling as well as adult stages.

Qualitative and quantitative analysis regarding to mode of inheritance, goodness of fit to expected ratio of the phenotype classes concerning the stripe rust severity and infection type were determined using X² analysis Steel and torrie, (1960). The minimum number of effective genes controlling slow-rusting resistance in each cross was estimated by the formula of Wright (1968). Degree of dominance was calculated according to the method suggested by Romero and Frey (1973). Heritability in its broad-sense was estimated according to Lush (1949).

RESULTS

Stripe rust infection type developed uniformly throughout the experiments and parental varieties exhibited consistent disease reactions each year, for both seedling and adult stages. Genetic behavior of crosses between Anza YrA/+ 6 commercial wheat cultivars against races 230E18 at seedling stage under greenhouse conditions in 2006/2007 growing season.

Data presented in Table (1) indicated that this group represented by six crosses was susceptible / susceptible. The F₁ plants reaction tend direction susceptible similar to their parental reaction. Regarding F₂ plant population, data indicated that 6 tested crosses, segregated in the direction of susceptibility dominance. However, the number of F₂ resistant plants : susceptible one of these crosses were 82:112, 97:108, 34:114, 40:155, 43:160 and 17:179 goodness of fitted the theoretical expected ratio i.e., 7:9, 7:9, 7:9, 3:13, 3:13 and 1:15 which suggested digenic control with two independent recessive genes conditioning reaction to race 230E18 (Table, 1).
Table (1): Stripe rust Infection Type of 6 crosses between Anza (YrA+) and 6 commercial wheat cultivars against race 230 E18 at seedling stage under greenhouse conditions in 2006/2007 growing season.

<table>
<thead>
<tr>
<th>No.</th>
<th>Cross name</th>
<th>Infection Type race 230E18</th>
<th>Observed ratios</th>
<th>Expected ratio</th>
<th>X²</th>
<th>P. values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Susceptible X Susceptible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Anza A'/ Gemmeiza7</td>
<td>P₁ 2 18</td>
<td>3 17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F₁ 3 17</td>
<td>F₂ 3 17</td>
<td>41 64 7 82:112</td>
<td>7.9</td>
<td>0.26</td>
<td>0.75-0.50</td>
</tr>
<tr>
<td>2</td>
<td>Anza A'/ Giza168</td>
<td>P₁ 2 18</td>
<td>P₂ 2 18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F₁ 3 17</td>
<td>F₂ 27 70</td>
<td>51 50 7 97:108</td>
<td>7.9</td>
<td>1.05</td>
<td>0.50-0.25</td>
</tr>
<tr>
<td>3</td>
<td>Anza A'/ Sakha 94</td>
<td>P₁ 2 18</td>
<td>P₂ 19 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F₁ 17 3</td>
<td>F₂ 34 50</td>
<td>25 60 29 84:114</td>
<td>7.9</td>
<td>0.14</td>
<td>0.75-0.50</td>
</tr>
<tr>
<td>4</td>
<td>Anza A'/ Sids1</td>
<td>P₁ 2 18</td>
<td>P₂ 1 19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F₁ 17 3</td>
<td>F₂ 35 5</td>
<td>50 50 45 40:155</td>
<td>3.13</td>
<td>0.387</td>
<td>0.75-0.25</td>
</tr>
<tr>
<td>5</td>
<td>Anza A'/ Sakha8</td>
<td>P₁ 2 18</td>
<td>P₂ 1 19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F₁ 17 3</td>
<td>F₂ 18 25</td>
<td>30 50 70 43:160</td>
<td>3.13</td>
<td>0.78</td>
<td>0.50-0.25</td>
</tr>
<tr>
<td>6</td>
<td>Anza A'/ Sakha69</td>
<td>P₁ 2 18</td>
<td>P₂ 3 17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F₁ 17 3</td>
<td>F₂ 5 12</td>
<td>29 60 60 17:179</td>
<td>1:15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Identification of adult-plant stripe rust resistance gene (YrA+) in some Egyptian commercial wheat cultivars:

To identify Anza (YrA+) governing wheat adult plant resistance to stripe rust, 6 crosses between variety Anza (YrA+) and each of the six commercial wheat cultivars i.e., Gemmeiza7, Giza168, Sakha94, Sids1, Sakha8 and Sakha69 were used. Data presented in Table (2) indicate that 6 crosses could be divided into two categories i.e., resistant/ resistant and resistant/susceptible.

The first category:

This group was represented by 4 crosses indicated that either of the tested parents showed resistance response against races mixture of stripe rust disease. The F₁ tested plants, showed the same trend with their parents (giving resistant reaction). Regarding the F₂ plant populations, two out of four crosses segregated in ratios ranging between resistant and susceptible type i.e. Anza A'/Gemmeiza7 and Anza A'/Sids1, which fitted the expected ratio 15L:1H indicating that the cultivars Gemmeiza7 and Sids1 do not have this gene (YrA+) and each of them may carry different minor gene(s) that cause low disease severity. The other two crosses i.e., Anza A'/Giza 168 and Anza A'/Sakha94 were resistant and no segregation for susceptibility could be

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detected, these results proved that, these two cultivars likely carries the stripe rust resistance gene (YrA+).

Table (2): Stripe rust severity of crosses between Anza A+ (YrA+) and 6 commercial wheat cultivars under field conditions in 2006/2007 growing season.

<table>
<thead>
<tr>
<th>No</th>
<th>Cross name</th>
<th>Strip rust severity %</th>
<th>Observed ratios (L:H)</th>
<th>Expected ratio</th>
<th>X²</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anza A+/Gemm eiza7</td>
<td>19 1 2 18 64 75 43 12 7</td>
<td>182:19 15:1 2.37 0.25-0.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Anza A+/Giza16 18</td>
<td>19 2 17 3 142 48 15</td>
<td>205:0 1:0 0 &gt;0.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Anza A+/Sakha 94</td>
<td>19 3 18 2 150 30 21</td>
<td>201:0 1:0 0 &gt;0.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Anza A+/Sids1</td>
<td>19 1 1 2 88 62 41 12 4</td>
<td>191:16 15:1 0.74 0.50-0.25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The second group: resistant X susceptible

This group was represented by two crosses i.e, Anza A+/Sakha8 and Anza A+/Sakha69 the two cultivars i.e., Sakha8 and Sakha69 were susceptible while, Anza A+ was resistant. The F₁ tested plants showed resistance. The F₂ plants showed segregation to 139L:62H and 131L:69H, respectively, which fitted the expected ratio 3L:1H indicating that these two cultivars do not have this gene (YrA+) and each of these may carry different minor gene(s) that cause low disease severity.

Quantitative analysis:

To study genetic behavior of infection type and wheat partial stripe rust resistance quantitatively, the two parents, F₁ and F₂ populations for each of the six crosses were tested at seedling and adult stages under greenhouse and field conditions. Population means and variance of the parents, F₁’s and F₂’s were used to estimate the degree of dominance for F₁(h₁) and F₂(h₂), the
heritability in its broad-sense and the number of functioning genes for each cross (Tables 3 and 4).

**Under greenhouse conditions: at seedling stage**

Data presented in Table (3) proved that the disease severity % to cvs. Anza A+, Gemmeiza7, Giza168, Sakha94, Sids1, Sakha8 and Sakha69 were 7.9, 8.85, 7.05, 8.95, 8.95 and 8.85, respectively. The \(F_1\) and \(F_2\) mean values in six crosses appeared values lower than their mid-parent values, revealing the presence of resistance (low infection type).

**Table (3): Means of \(P_1\), \(P_2\), \(F_1\), \(F_2\), and MP, degree of dominance of \(F_1\) (\(h_1\)) and \(F_2\) (\(h_2\)) as well as broad-sense heritability for infection type of 6 wheat crosses inoculated with \(P.\ striiformis\) f. sp. tritici at seedling stage under greenhouse conditions in 2006/2007 growing season.**

<table>
<thead>
<tr>
<th>No.</th>
<th>Cross name</th>
<th>Infection type means of</th>
<th>Degree of dominance</th>
<th>Heritability</th>
<th>No. of genes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Susceptible X Susceptible</td>
<td>(P_1)</td>
<td>(P_2)</td>
<td>(F_1)</td>
<td>(F_2)</td>
<td>MP</td>
</tr>
<tr>
<td>1</td>
<td>Anza A+/Gemmeiza7</td>
<td>7.9</td>
<td>8.85</td>
<td>7.85</td>
<td>6.33</td>
</tr>
<tr>
<td>2</td>
<td>Anza A+/Giza168</td>
<td>7.9</td>
<td>8.9</td>
<td>7.85</td>
<td>6.23</td>
</tr>
<tr>
<td>3</td>
<td>Anza A+Sakha 94</td>
<td>7.9</td>
<td>7.05</td>
<td>7.15</td>
<td>6.57</td>
</tr>
<tr>
<td>4</td>
<td>Anza A+Sids1</td>
<td>7.9</td>
<td>8.95</td>
<td>7.15</td>
<td>7.2</td>
</tr>
<tr>
<td>5</td>
<td>Anza A+Sakha8</td>
<td>7.9</td>
<td>8.95</td>
<td>7.15</td>
<td>7.3</td>
</tr>
<tr>
<td>6</td>
<td>Anza A+Sakha69</td>
<td>7.9</td>
<td>8.85</td>
<td>7.15</td>
<td>7.9</td>
</tr>
</tbody>
</table>

MP = mid parents

Expression of gene actions measured as the degree of dominance \(h_1\) and \(h_2\) has been shown in Table (3). The estimated values of \(h_1\) and \(h_2\) also, demonstrated the significant negative values of \(h_1\) and \(h_2\) (low infection type less than mid-parents) also, suggested the manifestation of resistance for stripe rust resistance.

**Under field conditions: at adult stage**

The obtained data in Table (4) revealed that the disease severity % were 0.1095, 7.4, 3.8, 1.702, 7.8, 38.5 and 49.0 for the cultivars i.e., Anza A+, Gemmeiza7, Giza168, Sakha94, Sids1, Sakha8 and Sakha69, respectively. The \(F_1\) and \(F_2\) means showed values lower than these calculated for their respective mid-parents, revealing the presence of partial dominance for low-disease severity confirming the results obtained from \(F_1\)'s (Table, 4).

Expression of gene action measured as the degree of dominance \(h_1\) and \(h_2\) has been shown in the same Table. The estimated values of \(h_1\) and \(h_2\) exhibited negative values in these six crosses suggested the manifestation of partial dominance for stripe rust resistance and supported the \(F_1\) results.

The heritability values for all tested crosses at seedling and adult stages are considered to be high, for the above mentioned six crosses (Tables, 3 and 4).

Number of genes: the minimum number of effective genes controlling the resistance was digenic recessive for each of the six crosses at the seedling stage (Table, 3). On the other hand, in the adult stage, the
difference between each two parents is controlled by dominance mono or digenic since the calculated number of genes was recorded in Table (4).

Table (4): Means of P₁, P₂, F₁, F₂, and MP, degree of dominance of F₁ (h₁) and F₂ (h₂) as well as broad-sense heritability for rust severity (%) of 6 wheat crosses inoculated with P. striiformis at adult stage under field conditions in 2006/2007 growing season.

<table>
<thead>
<tr>
<th>No.</th>
<th>Cross name</th>
<th>Rust severity means of</th>
<th>Degree of dominance</th>
<th>Heritability</th>
<th>No. of genes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>P₁</td>
<td>P₂</td>
<td>F₁</td>
<td>F₂</td>
</tr>
<tr>
<td>1</td>
<td>Anza A*/Gemmeiza7</td>
<td>0.109</td>
<td>7.4</td>
<td>1.801</td>
<td>2.43</td>
</tr>
<tr>
<td>2</td>
<td>Anza A*/Giza168</td>
<td>0.108</td>
<td>3.8</td>
<td>0.31</td>
<td>0.77</td>
</tr>
<tr>
<td>3</td>
<td>Anza A*/Sakha 94</td>
<td>0.109</td>
<td>1.7</td>
<td>0.21</td>
<td>0.72</td>
</tr>
<tr>
<td>4</td>
<td>Anza A*/Sids1</td>
<td>0.109</td>
<td>7.8</td>
<td>1.801</td>
<td>2.1</td>
</tr>
<tr>
<td>5</td>
<td>Anza A*/Sakha8</td>
<td>0.109</td>
<td>38.5</td>
<td>2.2</td>
<td>7.24</td>
</tr>
<tr>
<td>6</td>
<td>Anza A*/Sakha69</td>
<td>0.109</td>
<td>49.0</td>
<td>4.4</td>
<td>7.22</td>
</tr>
</tbody>
</table>

DISCUSSION

Seedling reaction of crosses between Anza A*/Gemmeiza7, Anza A*/Giza168, Anza A*/Sakha94, Anza A*/Sids1, Anza A*/Sakha8 and Anza A*/Sakha69 showed segregation patterns of their crosses confirming resistant : susceptible ratios i.e., 7:9, 7:9, 7:9, 3:13, 3:13 and 1:15, respectively, which suggested digenic control with two independent recessive or partial dominant gene conditions with epistasis (Table, 1). These results disagreed with those of Macer (1972) who reported that the line (S) had one gene for seedling resistance (3 resistance/1 susceptible). While, the results in this work were agreed with those of Allan and Purdy (1970) and Griffy and Allan (1988) who suggested that Alba resistance was controlled by one or two genes but varied from that studied by Zadoks (1961) who reported recessive monogenic control. Genetic interpretation of adult plant reaction to the fungus in the field during one season (Anza A*/ Gemmeiza7 Anza A*/sids1) indicated digenic control of resistance and this result is in agreement with these of Allan (1968) and Allan and Purdy (1970), respectively.

However, the latter authors reported monogenic control of seedling resistance in one cross. Anza A* / Sakha8 and Anza A*/ Sakha69 which indicated monogenic control for resistance agreed with Macer (1972). Griffey and Allan (1988) with resistant by susceptible cross, they suggested that one or two genes control seedling and adult plant reactions among most of lines. Singh and Rajaram (1994) showed that adult plant resistance to stripe rust in the ten cultivars was controlled by one to three genes. Broers (1997) pointed to that quantitative resistance in wheat to yellow rust is characterized by susceptible infection type in the seedling stage (but not in the adult plants in the field) and a slow-epidemic development (Park et al., 1988, Park & Rees, 1989 and Broers et al.,1996). Several breeding strategies can be incorporated resistance genes into breeding populations (Robbelen & Sharp, 1978; CIMMYT, 1988 and Knott, 1989). The seedling factor in Anza A* is only
effective at the growth stage in combination with other genes, but another gene YrH gives it the protection in the adult stage. The epistatically expressed seedling resistance gene is believed to be YrA+ by Willing et al., (1988). Zwer and Qualset (1994) pointed to that there are two genes in Anza contribute to the durability of “Anza” as resistant variety.

The quantitative analysis in all tested crosses at seedling and adult stages, the F₁ and F₂ population mean values were found to be lower than their respective mid-parents. The estimated values of degrees of dominance (h₁ and h₂) were significant and negative in all six crosses (at seedling and adult sages) under study. These results supported the manifestation of partial resistance according to the method adopted by Millus and Line (1986), Shehab El-Din et al. (1991a, 1991b) and Shehab El-Din and Abdel-Latif (1996), Negm (2004) and Shahin (2005).

The high heritability values are indicated for high rate of success in recovering the desired genes in future generations. Also, these high estimates indicate that the selection for this character in early segregations could be possible. While, delaying it would be more effective, these results are in harmony with those of Kuhn et al. (1980), Lee and Shamer (1985), Shehab El-Din and Abdel-Latif (1996), Najeeb et al.,(2004) and Negm (2004).

The genes controlling seedling and adult plant resistance to stripe rust Pt CDL-6 in resistant variety Anza were YrA+ at seedling and YrA+, YrH at adult stages according to Zewer and Qualset (1994). This gene assignment show that each variety has a seedling resistance gene that is also, effective in the adult stage. The analysis also, provided further evidence that Anza has two resistance factors, one that was detectable in the seedling stage only in combination with other resistance genes and the other that was expressed a recessive gene in the adult stage. The first gene they believed was YrA+ identified by Willing et al. (1988) and the other one is designed as YrH. The adult plant resistance to stripe rust is controlled by at least two or more genes (Wallwork and Johnson, 1984; Bariana and McIntosh, 1995; Afshari, 2000; Gosal, 2000 and Singh et al., 2000).

Anza A+ possessed a susceptible phenotype when inoculated with pathotype (race) 230E18. Also, six cultivars showed susceptibility against this race at seedling stage. The F₁ seedling from these crosses revealed susceptibility. The F₂ population was segregated into two gene pairs. The dominance trend direction of susceptibility. The resistance genes were recessive against the above mentioned race at seedling stage under greenhouse conditions. On the other hand, under field conditions Anza A+ possessed a resistant (R) phenotype when inoculated with races mixture of P. striiformis at adult stage, also, the F₁ from the crosses Anza A+/6 cultivars showed resistance. The F₂ populations were segregated with 4 crosses fitted the expected ratios 15(R):1(S) and 3(R):1(S). on the other hand, the rest two crosses i.e., Anza A+/Giza168 and Anza A+/Sakha 94 showed no segregation and dominance of resistance, indicating that their varieties have the adult plant resistance gene A+ (Eversmeyer and Kramer, 2000).

These findings showed that this gene is effective under the Egyptian environment and it was included in two of the tested wheat cultivars.
Therefore, it may be transferred to the Egyptian genetic materials as a stripe rust resistance source in breeding program.

REFERENCES


Youssef, I. A. M. and M. S. Hamada


التنبؤ بوراثة مقاومة الصدأ الأصفر من خلال تهجين الصف +Anza A في ستة أصناف من القمح المصري

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**قسم الوراثة – كلية الزراعة بدمياط – جامعة المنصورة.

تم تهجين الصنف +Anza A (Triticum aestivum, L.) مع ستة أصناف قمح مصرية. تم اختبار الأصناف والجيل الأول والثاني في مرحلة البادرة تحت ظروف الصدأ الأصفر ضد السلالة 230E18 من المعادن السببية سترايفورم. أعط كل من الأصناف والجيل الأول والثاني مظهر مقاوم شكلًا مظهريًا فعالًا للإصابة. كما حدث العزل في الجيل الثاني مع كل الهجینة على زوجين من الأصناف حيث كانت المقاومة متناوبة في كل هجینة. من جهة أخرى في مرحلة النبات البالغ تحت ظروف العزل الفعلي ضد مخلوط من سلالات المعادن السببية المرضية فقد أعط الصنف +Anza A مختلف مظهرًا مظهريًا مقاومًا. أيضاً؛ ونتجت مقاومة مع كل الهجینة من +Anza A. أما الجيل الثاني فقد حدث العزل في أربعة هجینة حيث أن كلها متنقلة مع النسبة المتوقعة (S: 1: R: 15). لكن هناك واحدة تم العزل بشكل غير عام في +Anza A و pair Anza 94 Sakha/Anza A 168 Giza. وُسَخًا 94 رَمَك جين المقاومة الجزيئية للأسمار في طور النبات البالغ (YrA) تحت ظروف العزل عن طريق الوراثة. النتائج تشير أن هذا الجين مثبط تحت ظروف البيئة المصرية. النتائج تتناقض مع النتائج المتنقلة وقيمة زوجين من الجينات السائدة في الأصناف البالغة. بعض الجينات المتنقلة في البذور. هذه النتائج تدل على أن الوراثة من الجينات المتنقلة في الأجيال المبكرة تحكم تأثير الصفة.

*References:


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