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SCREENING AND DEVELOPING WHEAT LINES RESISTANT TO *S.GRAMINUM* AND *R.PADI*

YOUSSEF, G.S.[1], I.A. MARZOUK[2] AND M.A. EL-HARIRY[2]

1 Field Crops Resreach Institute, Agricultural Research Centre, Giza, Egypt.
2 Plant Protection Research Institute, Agricultural Research Centre, Dokki, Egypt.

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Abstract

A breeding program for screening and developing wheat lines resistant to aphid was conduted at ARC since 1986. Crosses were made between the two translocation lines each possessing a segment of a chromosome from the rye variety Insave x Giza 157, Sakha 61 and Sakha 69. Backcrossing was continued up to BC3/BC4. Individual plant selection based on resistance/tolerance to *R.padi* the most destructive aphid in Egypt, and desirable plant phenotype was followed. Each of the selected plants phenotype was followed. Each of the selected plants was grown in one row and selection was practiced within and among rows. Visually superior lines resistant/tolerant to aphids were included in yield trails for aphid screening and yield evaluation from 1991 and through 1996. Eight lines possessing varying degress of aphid resistance were experimented in two verification, two large and two small yield trials consisting of 11, 27 and 42 lines, respectively. The recurrent varieties Sakha 69 and Giza 164 were used as control in each experiment. Two fairly resistant lines to *R.padi*, exhibited grain yield to the recurrent, two moderate and 3 tolerant lines exhibited grain yield significantly two moderate and 3 tolerant lines exhibited grain yield significantly increased over the recurrent were achieved from the verification trials. these lines will be handed over to the Wheat Res. Section to be experimented in 11 location allover the country and for seed multiplication.

Results from small and large trials will be confirmed in the coming seasons. These results positively assume that various levels of resistance can be combined with high grain yield and breeding for aphid resistance/tolerance can be achieved.

Another phase of this program has been initiated using the resistant amphiploids Amigo, Largo and Shandawell 1 (produced in this work) x Giza 160, 163 and 164. A total of 720 lines selected from BC2 were subjected to artificial infestation with aphids in the greenhouse and natural infestation of *R.padi* in the field. Six lines (Largo x Giza 160) and 6 lines (Amigo x Giza 164) proved to be resistant to *S.graminum* under greenhouse conditions. An excess of resistant lines was obtained under field conditions against *R.padi* because infestation was light.

INTRODUCTION

Wheat losses due to insect pests attack are great. Over 30% yield losses have been attributed to aphid damage in wheat alone in aphid hot spot areas.

Insects are not only responsible for massive losses of productivity as a result of herbivory but also they serve as the vectors of many causative pathogens of numerous plant diseases. The physical damage caused by insects to plants facilitate their infection by other soil or airborne pathogen organisms.

Wheat crop is usually attacked by many species of insects and mites among which aphids are the most hazardous in Egypt. Wheat plants are liable to infestation with several aphid species, but the most important of those are the greenbug *Schizaphis graminum* which is wide spread throughout the world and the cherry oat bird aphid *Rhophalosiphum padi* which is dominating in Egypt as well as other parts of the world.

Aphid control methods are mainly chemical, biological and genetical. Chemical methods are very expensive, hard to reach in remote areas, poisonous and causes environment pollution. Biological control is only used on a small scale and and can hardly cover large areas. Advances in molecular biology made it possible to produce insecticide protein within the plant itself in a large number of crop species. Transgenic plants which express crystal gene produced by the insect pathogenic bacterium, *Bacillus thurengensis*, (Bt) has been obtained. Bt has been in limited use as a biological control agent and a modified gene encoding the Bt toxin provided the first example of molecular resistance in plants. Despite progress with Bt expressing resistance there is some concern that a further use of Bt toxin may lead to dependence on a single factor for resistance and that potential may be broken down by the pest by developing a virulent gene.

With the advance of integrated pest management concept, the use of insect-resistant plants in combination with other control measures is possibly the most convenient and economical approach for pest control. Its desirable features include specificity to one or several pests, cumulative effectiveness, compounded in successive insect generations, persistence for several years, harmony with the environment, ease of adaptation into normal farm operations, usually at no extra cost, and compatibility with other tactics in pest management (Pathak, 1970 and Kogan, 1982).

Painter (1951) proposed three general mechanisms to account for plant resistance to insect damage: (1) non-preference (the terms non-acceptance and antixenosis were proposed by Van Marrwwizk and DePointi, 1975 and Kogan and Ortman, 1978, respectively), which is shown by plants that are unattractive or unsuitable for colonization or oviposition by an inset; (2) antibiosis, which adversely affects the insect life history, such as reduced growth, repoduction or survival, when the insect uses a resistant host plant for food; and (3) tolerance, which enables a host plant to grow and repoduce itself or to repair injury to a market degree in spite of supporting a population approximately equal to that damaging a susceptible host. Russell (1978) suggested a fourth type or resistance, pest avoidance, which is a tendency to escape infestation, e.g. because the host plant is not at a susceptible stage when pest populations are at their peak.

On the other hand, basic plant characteristics that may impart resistance or susceptibility to insects can be morphological, such as variation in foliage size, shape, colour, pubescence, hardness or thickness of tissue and especially the proportion of esential nutrients, and also all elochemic factors such as allomones (e.g. repellents, toxicants, feeding deterrents) and kairomones (e.g. attractants, arrestants), Kogan (1982).

Aphid control through nonconventional breeding methods (genetic) is becoming the most efficient and economic way to control aphids. Large efforts to develop insect resistance are being made and success has been achieved in developing wheat resistance to hesian fly, wheat stem sawfly, cereal leaf beetle and aphids (Painter, 1951).

Although aphids are so aggressive and resistance to them is apparently, so scarce among cultivated wheat lines and cultivars resistance to aphids has been found among certain types and related species. The first transfer of aphid, resistance to wheat was achieved from a rye variety called " Insave" through crossing this variety with wheat and treating the F1 spikes at anthesis with X-ray just before pollination. Selecting resistant wheat translocation lines was then followed. Other types of resistance have been found among *Aegilopes, Agropyron* and *Elymus* species.

During the current investigation, the amphiploid resistant sources Amigo, Largo and Shandweel 1 were used in crosses with local varieties Giza 160, Giza 162 and Giza 164 in an attempt to develop aphid resistant wheat germplasm.

MATERIALS AND METHODS

Crosses between the resistance sources Amigo, Largo, Shandaweel 1 and each of the commercial Egyptian wheat varieties Giza 160, Giza 162, Giza 163 and Giza 164 were made in 1992. Around 720 wheat lines were selected from selfed BC2 and grown in single rows 3.5 m long in the field at Shandaweel Res. Station where excellent natural aphid infestation occurs in the field at Shandaweel as well as heavy artificial infestation with *S.graminum* or *R.padi* under greenhouse conditions.

Advanced wheat lines from selfed BC3/BC4 (Bush/Amigo T101 and T105 x Giza 157, Sakha 61 and Sakha 69) were tested in experimental yield trials for resistance against *S.graminum* and *R.padi* as well as for their yield potential at Shandawell, Mallawy and Sids Res. Stations in experimental yield trials as follows:

a- Two verification yield trials included 5 and 6 wheat lines, each was broadcasted in a large plot 6 x 7 m.

b- Two large experimental yield trials comprised 11 and 16 wheat lines, each line was drilled in 12 rows 3.5 m and 4.0 m long, respectively.

c- Two small yield trials consisted of 20 and 22 entries. Each entry (line/variety) was drilled in 6 rows, 3.5 m long, 20 cm between rows, and 4 replicates.

In each of these trials, the wheat lines were experimented along with the two commercial leading wheat varieties Sakha 69 and Giza 164. The lines and varieties in each experiment were arranged in randomized complete block design.

Field screening: Natural aphid infestation under conditions differ in intensity from one season to another due to differences in environmental conditions. The reaction of plants exposed to insect attack is usually measured at the proper stage of plant growth and the highest infestation of insects. This is often done by determining plant area occupied by aphids in percentage compared to total plant area. Other measurements of aphid reaction in the field like visual counting or the effect of insects to which environmental factors influence the expression of resistance for field scaling and screening (Youssef and Mosaad 1995).

Field tolerance test: Varieties of lines that exhibited no yield losses under heavy natural infestation compared with susceptible varieties which are largely destroyed are considered tolerant. For evaluating tolerance in the field, tested wheat lines are grown in single rows at a hot spot. Vigorous infested plants exhibiting large number of dense long and well filled spikes within one row are considered tolerant compared with susceptible varieties suffering high aphid population density.

RESULTS AND DISCUSSION

Natural infestation with *R.padi* in the field at Shandawell has not been satisfactorily intense in 1995/1996 season. The differences in natural aphid infestation are due to fluctuation in humidity and temperature. During this particular season, the winter was mild and dry and thus negatively affected infestation. Data of the previous two seasons recorded under dense natural infestation are used for evaluating the test material in relation to resistance to *R.padi*. Data on grain yield (kg/plot) has been precisely determined for evaluating the yield potentials for the wheat lines included in each experiment in comparison with the check varieties and will be discussed in combination with aphid resistance.

1. Greenhouse screening test

A total of 720 wheat lines (Largo, Amigo or Shandaweel 1 x Giza 162 or Giza 164) were screened for resistance to greenbugs. Symptoms of greenbug infestation were visible, clear and distinct on wheat lines as on the susceptible variety Giza 157. Population growth of greenbug 12-14 days after infestation was enormous. The reaction of greenbug on individual plants of each of the 720 lines tested was recored. The results of the screening test clearly indicated that out of all the tested lines, 11 lines proved to be resistant (5 lines of Amigo x Giza 164 and 6 lines of Largo x Giza 160) with individual plants of infestation type 1, Table.

Table 1. Reaction of selected wheat lines and pedigree at the seedling stage in the greenhouse.

No.	Pedigree	Plant number									
		1	2	3	4	5	6	7	8	9	10
185	Giza 160xLargo	1	1	1	1	1	1	1	1	1	1
301/2	Giza 160xLargo	1	1	1	1	1	1	1	1	1	1
312/4	Giza 164xAmigo	1	1	1	1	1	1	1	1	1	1
322/2	Giza 164 x Bush/Amigo T105	1	1	1	1	1	1	1	1	1	1
636/3	Giza 160 x Largo	1	1	1	1	1	1	1	1	1	1
755/3	Giza 160 x Largo	1	1	1	1	1	1	1	1	1	1
756/3	Giza 160 x Largo	1	1	1	1	1	1	1	1	1	1
757/2	Giza 160 x Largo	1	1	1	1	1	1	1	1	1	1
759/3	Giza 160 x Largo	1	1	1	1	1	1	1	1	1	1
760/2	Giza 160 x Largo	1	1	1	1	1	1	1	1	1	1
880/3	Giza 164xBush/amigo /T105	1	1	1	1	1	1	1	1	1	1
881/1	Giza 164xBush/amigo /T105	1	1	1	1	1	1	1	1	1	1
883/1	Giza 164xBush/amigo /T105	1	1	1	1	1	1	1	1	1	1

Experimental yield trials

Advanced lines resistant/tolerant to aphids were produced in our aphid breeding program by crossing the two resistant translocation lines each with the commercial local varieties Giza 157, Sakha 61 and Sakha 69 in 1986. F1's plants were crossed and backcrossed with each of the recurrent varieties 3 and 4 times up to 1990.

Selected individual plants from among BC3/BC4 were grown in single rows and selection was practiced among and within rows based on resistance/tolerance to aphids and desirable plant phenotype. Selected rows were grown each in two rows for seed multiplication and more selection before introducing them into experimental yield trails. Best rows were included in small yield trials. Best lines were then involved in large and then verification yield trials.

Verification yield trials

Two verification trials were conducted at Shandaweel, Mallawy and Side Research Stations to assess their resistance/tolerance to aphids beside performance and for seed multiplication. These trials included the most advanced and promising lines in grain yield and aphid tolerance.

Verification Trial 1

The 5 lines of this experiment were selected for their resistance to *S.graminum* during the seedling stage. Statistical analysis indicated significant difference among lines and varieties tested at Mallawy but not at Shandaweel, Table 2.

Table 2. Grain yield and field reaction to *R.padi* of some resistant lines to *S.graminum* selected from BC3/BC4 grown in verification yield trials 2.

No.	Pedigree	*R.padi* reaction %	Grain yield					
			1991	1992	1993 (kg/plot)	1994	1995	1996 (t/ha)
1	Giza 163xSakha 69	50.00	0.82	1.22	0.37	1.51	5.23	7.631
2	Giza 163xSakha 69	40.50	1.00	1.09	0.48	1.39	6.16	7.258
3	Giza 163xSakha 69	40.00	0.96	1.08	0.62	1.50	4.84	6.779
4	Giza 163xSakha 69	20.30	0.98	0.95	0.59	1.22	6.18	8.357
5	Giza 163xSakha 69	70.00	0.88	1.18	0.62	1.46	4.76	7.890
6	Sakha 69	70.80	0.83	0.96	0.55	1.21	5.37	6.482
7	Giza 163	70.00		0.65		1.00	5.89	6.701

CV% = 8.78 L.S.D at 0.05 level = 1.029

Line 4 (Bush/Amigo T105 x Sakha 69) hosting 40% aphids, the least aphid spread exhibited significant increase in grain yield over the recurrent variety Sakha 69 and the leading commercial variety Giza 164. It yielded 8.4t/ha compared to 6.5 t/ha and 6.7t/ha for Sakha 69 and Giza 164, respectively. This was followed by Lines 5 and 1 hosting 70 and 50% aphids and yielding 7.9 and 7.6 t/ha, respectively, Table 2. Line 4 proved to be also superior in grain yield at Shandaweel in 1991 and 1995 in large yield trial and line 5 in 1992, 1993 and 1994 in small yield trials.

Verification Trial 2

This experiment included the 6 *R.padi* resistant or moderately resistant lines. The resistant lines 1 and 2 (Bush/Amigo T101 x Sakha 69) were the least affected with *R.padi* hosting 10-20 and 20% aphids, respectively. Their yield potential was equal to the recurrent variety. Line No. 4 hosting 20-30% aphids significantly exceeded the recurrent variety Sakha 69 and Giza 164 in grain yield. It yield 4.6 t/ha at Shandaweel with an increase of 1.73 and 1.37 over Sakha 69 or Giza 164, respectively, Table 3.

Line 3 (Bush/Amigo T101 x Sakha 69) hosting 50.70% aphid was significantly higher in grain yield by 0.9 t/ha. It yielded 4.8 t/ha compared to 2.9 and 3.2 t/ha for Sakha 69 and Giza 164, respectively, Table 3.

Table 3. Grain yield and *R.padi* reaction for some lines selected from selfed BC3/BC4 grown in verification yield trials 2.

No.	Pedigree	*R.padi* reaction %	Grain yield					
			1991	1992	1993 (kg/plot)	1994	1995	1996 (t/ha)
1	Giza 163xSakha 69	10.20	0.82	1.22	1.01	0.57	2.97	3.433
2	Giza 163xSakha 69	20.00	0.89*	1.29*	1.09	0.57	3.03	2.800
3	Giza 163xSakha 69	50.70	0.63*	1.22	1.12	0.66*	4.34	4.764*
4	Giza 163xSakha 69	20.30	0.68	1.29*	1.43*	0.53	5.24	4.600*
5	Giza 163xSakha 69	30.00	0.67	1.15	1.39*	0.67*	4.90	4.403
6	Giza 163xSakha 69	50.70	0.89*	1.34*	1.37	0.64	5.23	4.230
7	Sakha 69	70.90	0.95	0.87	1.09	0.65	4.54	2.870
8	Giza 163	70.90	-	0.68	0.95	0.68	5.02	3.231

CV% = 18.14 L.S.D at 0.05 level = 1.014

Large yield trials

The large yield trials are conducted to confirm the results of the small yield trials, in connection with aphid resistance and yield performance, on a larger scale as well as to study the interaction between entries, location, and years at Shandaweel, Mallawy and Sids Res. Stations.

Experiment 1

Statistical analysis indicated significant differences among entries at Mallawy but not at Shandaweel or Sids. Coefficient of variation in the two latter locations was high. Lines No. 1, 2,3,6 (Bush/Amigo/T101 x Sakha 69) and 8 (Bush/Amigo T105) hosted 20-30% aphids for the first three lines and around 40-50% for the latter. This result confirms the data of previous seasons and clearly indicates that these lines can perform well in more than one location and year, Table 4.

Table 4. Grain yield and *R.padi* reaction for some wheat lines selected from selfed BC3/BC4 grown in small and large yield trials 1 at Shandaweel from 1992 through 1996.

No.	Pedigree	*R.padi* reaction %	Grain yield at Mallawy			
			1992	1993 (kg/plot)	1994	1995 (t/ha)
1	Bush/Amigo/T101xSakha 69	20.30	0.621	1.826	1.51	4.346
2	Bush/Amigo/T101xSakha 69	30.00	0.637	1.143	1..54	3.839
3	Bush/Amigo/T101xSakha 69	20.30	0.673	1.620	1.39	3.411
4	Bush/Amigo/T101xSakha 69	20.30	0.643	1.728	1.31	3.738
5	Bush/Amigo/T101xSakha 69	40.00	0.627	1.985	1.23	3.610
6	Bush/Amigo/T101xSakha 69	50.00	0.746	1.882	1.39	3.776
7	Bush/Amigo/T105xSakha 69	70.00	0.543	1.825	1.29	3.442
8	Bush/Amigo/T105xSakha 69	40.50	0.638	1.215	1.09	3.948
9	Bush/Amigo/T105xSakha 69	50.00	0.641	1.753	1.33	3.743
10	Bush/Amigo/T105xSakha 69	50.00	0.648	1.795	1.32	3.626
11	Bush/Amigo/T105xSakha 69	20.30	0.714	0.880	1.61	2.986
12	Sakha 69	50.70	0.532	1.305	1.12	3.244
13	Giza 164	70.00	-	-	1.47	2.396

CV% = 10.5 L.S.D at 0.05 level = 0.544

Experiment 2

Statistical analyses also indicated significant difference among entries at Mallawy. Lines No. 1, 4 and 11 (Bush/Amigo T101 x Sakha 69) hosting over 50% *R.padi* Significantly exceed Giza 164 in grain yield but not Sakha 69, Table 5.

These lines significantly exceeded the recurrent parent in 1993 at Shandaweell. Lines 7 and 9 that significantly exceeded Sakha 69 in 1993 and 1995 did not perform well at Mallawy in 1996.

Table 5. Grain yield and *R.padi* reaction for some wheat lines selected from selfed BC3/BC4 grown in small and large yield trials 2 at Shandaweel from 1992 through 1996.

No.	Pedigree	*R.padi* reaction %	Grain yield (kg/plot) 1992	1993	1994	1993
1	Bush/Amigo/T101xSakha 69	60-70	0.747	1.089	1.370	3.751
2	Bush/Amigo/T101xSakha 69	70	0.853	1.331	1.030	3.519
3	Bush/Amigo/T101xSakha 69	70-80	0.815	1.150	1.340	3.659
4	Bush/Amigo/T101xSakha 69	70	0.732	1.137	1.060	3.903
5	Bush/Amigo/T101xSakha 69	70	0.860	1.093	1.310	3.549
6	Bush/Amigo/T101xSakha 69	40-60	0.911	1.228	1.480	3.351
7	Bush/Amigo/T101xSakha 69	60	0.838	1.283	1.540	3.336
8	Bush/Amigo/T101xSakha 69	60	0.842	1.296	1.460	3.759
9	Bush/Amigo/T101xSakha 69	70	0.866	1.426	1.710	2.807
10	Bush/Amigo/T101xSakha 69	60	0.807	0.555	1.240	3.313
11	Bush/Amigo/T101xSakha 69	70	0.737	1.193	1.080	3.969
12	Bush/Amigo/T101xSakha 69	70	0.775	1.450	1.440	3.123
13	Bush/Amigo/T101xSakha 61	60-70	0.573	1.391	1.530	3.096
14	Bush/Amigo/T101xSakha 61	70	0.667	1.235	1.390	3.317
15	Bush/Amigo/T101xSakha 61	70	0.675	1.395	1.320	3.490
16	Bush/Amigo/T101xSakha 61	40-50	0.362	1.631	1.380	3.424
17	Sakha 69	50-90	0.511	1.358	1.140	3.710
18	Giza 164	40-50	0.740	1.114	1.500	3.076

CV% = 14.14 L.S.D at 0.05 level = 0.6779

Small yield trials

Experiment 1

Significant difference among entries was found at Shandaweel Res. Station and Sids but not at Mallawy. The fairly resistant lines 13, 15 and 18, hosting 10-20% aphids *R.padi* significantly exceeded Sakha 69 in grain yield at Shandaweel, Table 6. The semi resistant lines 4, 5, 8 and 14 hosting 20-30% aphids, also significantly exceeded Sakha 69 in grain yield, Table 6.

Stress should be made on the first group of lines since resistance to aphid is a primary goal. These lines through exhibited grain yield that did not differ from Sakha 69 in 1995, the latter variety was exceptionally high in grain yield that year.

Experiment 2

Statistical analysis proved that significant difference existed between entries at Sids but not at Shandaweel or Mallawy. The fairly resistant lines No. 15 and 16 (hosting 10-20% aphids) exceeded significantly Giza 164 in grain yield but were equal to the recurrent parent, Table 7. The same lines (15 and 16) in addition to lines 8 and 18, significantly exceeded Sakha 69 in grain yield, while line 16 and to a less extent line 8 in particular from among all fairly resistant lines were high in grain yield in all three locations, Table 7. The fairly resistant line No. 18, which is square headed and equal to Sakha 69 in grain yield and medium tall, can be considered one of the segregant or crossed over lines that combine resistance and medium height.

Table 6. *R.padi* reaction and grain yield of some wheat lines selected from selfed BC3/BC4 grown in small yield trials 2 at Shandaweel during 1995 and 1996.

No.	Pedigree	*R.padi* reaction %	Grain yield		
			Mallawy (kg/plot, 4 rows)	Shandaweel (kg/plot, 4 rows)	Sids (kg/plot, 6 rows)
1	Bush/Amigo/T101xSakha 69	20-	1.695	1.004	4.035
2	Bush/Amigo/T101xSakha 69	20	1.716	1.042	3.680
3	Bush/Amigo/T101xSakha 69		1.710	1.203	4.060
4	Bush/Amigo/T101xSakha 69	30	1.758	1.678	4.088
5	Bush/Amigo/T101xSakha 69	20-30	1.607	1.392	3.623
6	Bush/Amigo/T101xSakha 69	10-20	1.759	0.794	3.520
7	Bush/Amigo/T101xSakha 69	10-20	1.684	0.987	3.978
8	Bush/Amigo/T101xSakha 69	20	1.725	1.280	3.570
9	Bush/Amigo/T101xSakha 69	20	1.922	1.003	3.973
10	Bush/Amigo/T101xSakha 69	20	1.820	1.252	4.090
11	Bush/Amigo/T101xSakha 69	20-30	1.816	1.154	4.445
12	Bush/Amigo/T101xSakha 69	20-30	1.567	0.798	3.947
13	Bush/Amigo/T101xSakha 69	10-20	1.551	1.574	3.728
14	Bush/Amigo/T101xSakha 69	20	1.416	1.283	3.103
15	Bush/Amigo/T101xSakha 69	10-20	1.766	1.221	3.678
16	Bush/Amigo/T101xSakha 69	10-20	1.579	1.135	4.178
17	Bush/Amigo/T101xSakha 69	10-20	1.875	1.023	3.793
18	Bush/Amigo/T101xSakha 69	10-20	1.709	1.339	3.660
19	Bush/Amigo/T101xSakha 69	30	1.680	1.570	3.683
20	Bush/Amigo/T101xSakha 69	20-30	1.743	1.086	3.505
21	Sakha 69	20-30	1.847	0.926	3.192
22	Giza 164	20-30	1.511	0.909	-

CV% = 15.16 L.S.D at 0.05 level = 1.05

Since chemical control methods are expensive, hard to be carried out in remote areas and ultimately will bring environmental pollution, also biological control strategies may be applied in a small scale and can hardly cover large areas, we can incorporate various levels of aphid resistance with high yielding varieties in a harmony with other controlling tactics as an approach to IPM programme.

Table 7. *R.padi* reaction and grain yield of some wheat lines selected from selfed BC3/BC4 grown in small yield trials 2 at Shandaweel in 1996.

No.	Pedigree	*R.padi reaction %*	Grain yield		
			Mallawy (kg/plot, 4 rows)	Shandaweel (kg/plot, 4 rows)	Sids (kg/plot, 6 rows)
1	Bush/Amigo/T101xSakha 69	20-30	1.615	1.448	3.580
2	Bush/Amigo/T101xSakha 69	20-30	1.573	1.564	4.150
3	Bush/Amigo/T101xSakha 69	20-30	1.437	1.464	3.777
4	Bush/Amigo/T101xSakha 69	30	1.597	1.716	4.340
5	Bush/Amigo/T101xSakha 69	30	1.486	1.915	3.692
6	Bush/Amigo/T101xSakha 69	20	1.672	1.590	3.853
7	Bush/Amigo/T101xSakha 69	20	1.599	1.549	3.840
8	Bush/Amigo/T101xSakha 69	10-20	1.528	1.547	3.980
9	Bush/Amigo/T101xSakha 69	20	1.671	1.409	4.228
10	Bush/Amigo/T101xSakha 69	20	1.482	1.421	3.865
11	Bush/Amigo/T101xSakha 69	20	1.384	1.352	3.530
12	Bush/Amigo/T101xSakha 69	20	1.579	1.449	2.605
13	Bush/Amigo/T101xSakha 69	20-30	1.257	1.204	2.323
14	Bush/Amigo/T101xSakha 69	30	1.507	1.349	4.000
15	Bush/Amigo/T101xSakha 69	10-20	1.409	1.557	4.385
16	Bush/Amigo/T101xSakha 69	10-20	1.645	1.678	4.283
17	Bush/Amigo/T101xSakha 69	10-20	1.403	1.217	2.550
18	Bush/Amigo/T101xSakha 69	10-20	1.504	1.635	3.443
19	Bush/Amigo/T101xSakha 69	10-20	1.438	1.443	3.515
20	Bush/Amigo/T101xSakha 69	10-30	1.508	1.630	3.857
21	Bush/Amigo/T101xSakha 69	10-20	1.774	1.295	3.877
22	Bush/Amigo/T101xSakha 69	10-20	1.610	1.185	3.920
23	Sakha 69	20	1.521	1.577	4.385
24	Giza 164	20	1.590	1.721	3.515

CV% = 17.62 L.S.D at 0.05 level = 0.92

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تقويم وإستنباط سلالات من القمح مقاومة لنوعى المن *R.padi, S.graminum*

جلال سالم يوسف١، إبراهيم على مرزوق ٢، مجدى عبد الحميد الحريرى٢

١ معهد بحوث المحاصيل الحقلية ، مركز البحوث الزراعية، الدقى ، الجيزة .

٢ معهد بحوث وقاية النباتات ، مركز البحوث الزراعية، الدقى ، الجيزة.

تم وضع برنامج تربية وتقييم قابلية بعض سلالات القمح للإصابة بحشرات المن منذ عام ١٩٨٦ . وبدأت الدراسة بتهجينات بين سلالتين تحتويان على قطعة كروموسوم من الراى (إنساف x جيزة ١٥٧) وسخا ٦١ وسخا ٦٩ ثم تم عمل تلقيح رجعى حتى الجيلين الثالث والرابع. وأنتخبت النباتات على أساس مدى المقاومة/التحمل لحشرة من الشوفان حيث تعتبر الآفة الرئيسية للقمح فى مصر، بالإضافة إلى الصفات الفينولوجية المرغوبة. وتم زراعة النباتات كل فى خط واحد ثم تم الانتخاب بين وخلال الخطوط. وأدمجت السلالات المبشرة سواء ذات المقاومة أو ذات التحمل للإصابة بحشرة المن فى تجارب محصولية لتقييمها بالنسبة للإصابة بالمن والمحصول منذ ١٩٩١ حتى ١٩٩٦ .

وتم التوصل إلى ٨٠ سلالة أظهرت درجات مختلفة من المقاومة لحشرة المن، وتم تجريبها فى تجارب تأكيدية (تجربتان كبيرتان وتجربتان محصوليتان مصغرتان). وتم زراعة الأصناف سخا ٦٩ وجيزة ١٦٤ كمقارنة وثلاثة سلالات متحملة للإصابة أعطت محصولاً أعلى من المقارنة. وأعطيت هذه السلالات لقسم بحوث القمح بمركز البحوث لتجريبها وإكثارها فى محطات البحوث المختلفة. ومن ناحية أخرى فقد تم إحداث تهجينات بين بعض الآباء البرية كالأميجو والارجو والصنف المقاوم شندويل مع بعض الأصناف المحلية مثل جيزة ١٦٠ ، جيزة ١٦٣ ، جيزة ١٦٤ .

وعرض التلقيح الرجعى الثانى للإصابة الصناعية تحت ظروف الصوبة لحشرات من القمح الأخضر والعدوى الطبيعية تحت الظروف الحقلية لحشرات من الشوفان وثبت وجود ستة سلالات تم الحصول عليها من (لآرجو x جيزة ١٦٠) وستة أخرى تم الحصول عليها من (أميجو x جيزة ١٦٤) أثبتت مقاومتها لحشرات من القمح الأخضر تحت ظروف الصوبة، بينما لم نتمكن من تقييم هذه السلالات حقليا لضعف الإصابة.