Proceeding Fifth Plant Breeding Conference May 27, 2007 (Giza)

Egypt. J. Plant Breed. 11(1): 411-421 (2007) Special Issue

INHERITANCE OF STRIPE AND LEAF RUSTS RESISTANCE IN SIX EGYPTIAN BREAD WHEAT CULTIVARS AND THEIR CROSSES

A.G. Abdel-Hafez[1], M. A. El-Hity[1], A. H. Abd El-Latif[2], A. A. E. Mohamed[1] and Thanaa H. Abd El-Kareem[2]

1. Agronomy Dept, Faculty Agriculture, University Kafr El-Sheikh
2. Wheat Res.Field Crop Res.Institute, Sakha. Agric. Res. Centre

ABSTRACT

An investigation was carried out during the period from1999 to 2002 to study the inheritance of stripe rust and leaf rust resistance in some cultivars of wheat and their hybrids. All possible crosses were carried out among six bread wheat cultivars, excluding reciprocals. Three different stripe rust and / or leaf rust resistance evaluations were conducted either in field or in greenhouse.

Heterosis, over mid-parent, in stripe rust disease was highly significantly negative in seven crosses without considerable heterotic effects over better-parent. Partial dominance was more frequent for most cases in stripe rust disease.

Positively heterotic effects, over the mid-parent, were obtained for leaf rust disease for 13 crosses. One cross; Giza 168 x Sakha 93; gave negative highly significant heterotic effects with no considerable heterotic effects over the better-parent. Over and partial-dominance ranges were more frequent for most crosses in leaf rust disease.

General and specific combining ability effects were highly significant for diseases and GCA / SCA ratio was more than unity. Sakha 93, Giza 168, Gemmeiza 9 and Sids 1, respectively were good combiner parents for stripe rust resistance, while, Giza 168, and Gemmeiza 9 were good combiner parents for leaf rust resistance. Furthermore, the best crosses were Giza 163 x Sakha 93, Sakha 8 x Sakha 93 and Giza 168 x Sakha 93 for stripe rust resistance, while, Giza 163 x Giza 168, Giza 168 x Gemmeiza 9 and Sakha 93 x Gemmeiza 9 were the best crosses for leaf rust resistance.

Resistance analysis for stripe rust at seedling stage gave evidence to the existence of two complementary dominant genes controlling resistance to stripe rust in the tested crosses except for the cross Giza 163 x Sids 1 which had two complementary recessive genes.

Resistance analysis for stripe rust at adult stage in field indicated the presence of two double dominant genes controlling the disease resistance in the cross Sakha 93 x Gemmeiza 9 and two complementary dominant genes controlling the inheritance of resistance in the cross Sakha 8 x Giza 168, but only one dominant gene was controlling the inheritance of resistance to stripe rust in the two crosses Giza 163 x Sids 1 and Giza 163 x Sakha 93.

Resistance analysis for leaf rust at adult stage in field indicated the presence of two complementary dominant genes controlling the inheritance of resistance to the disease in the cross Sakha 93 x Gemmeiza 9. However, it was indicated that two complementary recessive genes were present controlling the inheritance of resistance against leaf rust in Giza 163 x Sids1. On the other hand, one dominant gene and one recessive gene with complementary interaction were controlling the inheritance of resistance to leaf rust disease in the cross Giza163 x Sakha 93.

Key words: *Bread wheat, Leaf rust, Stripe rust, Inheritance, Resistance genes, Heterosis, GCA and SCA.*

INTRODUCTION

Wheat genetic improvement is an important aim for imcreasing yield through breeding programs. In Egypt, wheat production is confronted by many stresses, such as stripe or yellow rust (*Puccinia striiformis*) and leaf rust (*Puccinia recondite tritici*) as well as other biotic and abiotic stresses. Breeding of new cultivars is the only safety and most effective way to raise and sustain the wheat productivity. Most of the genetic studies indicated that resistance to stripe and leaf rust diseases is controlled by one or two genes, depending on the parents involved. Resistance is dominant in some crosses and recessive in the others Chen and Line (1993), Shehab El-Din *et al* (1996) and Shehab El-Din and Abd El-Latif (1996). The aim of the present investigation was to study the inheritance of stripe (yellow) rust and leaf rust in some cultivars of wheat and their hybrids.

MATERIALS AND METHODS

A study was conducted throughout the period from1999 to 2003 in field and greenhouse. Six common wheat cultivars, *Triticum aestivum* L. were used in this study; the names and pedigree of these cultivars are presented in Table (1).

Table 1. Cultivar name, pedigree, origin and its reaction to stripe (yellow) and leaf rusts of six Egyptian wheat genotpes

Cultivar	Pedigree	Origin	Reaction to	
			Stripe rust	Leaf rust
Giza 163	*T. aestivum* / Bonanza // Cno / 7c	Egypt	S	S
Giza 168	MRL/BUC//SERICM93046-8M-OY-OM-2Y-OB	CYMMIT	R	R
Sakha 8	Indus 66 / Norteno "S"PK 3418- 6S- 1SW- 0S	Egypt	S	S
Sakha 93	Sakha 92 / TR 810328 S.8871- 1S- 2S- 1S- 0S	Egypt	R	S
Sids 1	HD2172 / Pavon"S" // 1158.57 / Maya 74"S	Egypt	R	S
Gemmeiza 9	ALD"S"/HUAC//CMH 74A.630 /3X CGM4583-5GM-1GM-0GM	Egypt	R	R

R = Resistant and S = Susceptible

In 1999 / 2000 season grains, from each of the parental cultivars were sown and all possible cross combinations without reciprocals were made among the six cultivars, giving 15 crosses. In 2000 / 01 season, the F_1's from half diallel crosses and their parents were sown in a RCBD with three replications where the 15 F_1's were grown each in one row plot ,consisted of 20 plants spaced 20 cm apart and 30 cm between rows.

In 2001 / 02 season the parents, F_1's and F_2's of four crosses (Sakha 93 x Gemmeiza 9, Sakha 8 x Giza 168 ,Giza 163 x Sids 1 and Giza 163 x Sakha 93) involving four parents resistant to stripe rust (yellow) disease caused by *Puccinia striiformas* and two parents susceptible to stripe rust while, involving two parents resistant to leaf rust disease caused by *Puccinia recondita* and four parents susceptible to leaf rust, were sown in a RCBD. Each plot contained one row of each parent, one row of F_1, eight rows of F_2. Each row was 4 m long and 30 cm apart, and the seeds were spaced 20 cm within the row. Data were collected on individual plants in each row excluding the border plants.

In 2000 / 01 season, the 21 entries (15 F_1's and 6 parents) were planted in the field using the RCBD with three replications.The experiment was surrounded by 2 m wide spreader grown with a blend of highly susceptabile wheat cvs to stripe and leaf rust diseases to allow the possibility of high susceptibility with all possible pathotypes in the field. For the quantitative analysis, field response was converted into an average coefficient of infection using the method of Stubbs *et al* (1986). In this method, an average coefficient of infection could be obtained by multiplying infection severity by an assigned constant value namely, 0.2, 0.4, 0.6, 0.8 and 1 for resistant (R),moderate resistant(MR), intermediate(M), moderate susceptible(MS) and susceptible(S), reaction types, respectively.

Seedling tests for stripe rust had been carried out in the greenhouse of Sakha Agriculture Research Station, Plant Disease Research laboratory. During 2001 / 02 season, part of each the F_1's and F_2 and their parents of the four crosses (Sakha 93 x Gemmeiza 9, Sakha 8 x Giza 168. Giza 163 x Sids 1 and Giza 163 x Sakha 93) were tested.

Four pots for each of the parents and the F_1's, 30 pots of the F_2's, three times replicated (a total of 480 pots) were used, each pot contained 10 seeds. The plants were inoculated with the urediospores of the pathogen (*P. striiformis*) at seedling stage in the greenhouse using the rubbing technique (Stakman *et al* 1962). Infection type data has been recorded according to the method adopted by Stakman *et al* (1962). For the inheritance study, 0, 1, 2 and 3 reaction types were considered as the resistant class, while 4 and 5 reaction types were considered as an intermediate class, but reaction type 6, 7, 8 and 9 were considered as the susceptible.

Frequency distribution values were computed for parental, F_1 and F_2 populations for stripe rust reaction in all the crosses in the seedling tests. Besides under the field conditions, frequencey distribution values were computed, too. In respect to mode of inheritance, goodness of fit of the observed numbers to the expected ratio of the phenotypic classes concerning the stripe rust reaction were determined by X^2 analysis.

RESULTS AND DISCUSSION

Seedling tests in greenhouse

The main objective of this part was to study the behavior of the wheat crosses against stripe rust caused by a collection of different isolates from the pathogen *Puccinia striiformis*.

Resistant x Resistant parents

Table (2) illustarted the frquency distribution of seedling reaction of the two parents, F_1 and F_2 population of the cross Sakha 93 x Gemmeiza 9 against *P. striiformis*. The data indicated that the two resistant parents expressed the high resistant phenotype. Examination of the 20 F_2 plants of the same cross showed that all of them were resistant. Furthermore, F_2 plants showed that number of resistant, intermediate and susceptible plants were 179, 32 and 126, respectively. The phenotypic classes fitted the expected ratio 9: 7 with P. value = 0.05 (Table 3) indicating the presence of two complementary dominant genes controlling resistance to stripe rust.

Table 2. Frequency distribution of reaction of parents F_1 and F_2 population of four crosses at seedling stage against stripe (yellow) rust in greenhouse.

Cross No.	Crosses name	No. of tested plants	Types of infection (Reaction)		
			R	I	S
1	Sakha 93 x Gemmeiza 9				
	P_1	28	28		
	P_2	31	31		
	F_1	20	20		
	F_2	337	179	32	126
2	Sakha 8 x Giza 168				
	P_1	30			30
	P_2	39	39		
	F_1	15			15
	F_2	294	175	27	92
3	Giza 163 x Sids 1				
	P_1	30			30
	P_2	20			20
	F_1	17			17
	F_2	349	143	18	188
4	Giza 163 x Sakha 93				28
	P_1	28			
	P_2	35	35		
	F_1	12	12		
	F_2	345	200	31	114

R= resistant , I= intermediate , and S= susceptible

Table 3. Phenotypic classes of F_2 population of four crosses inoculated with stripe rust at seedling stage.

Cross No.	Crosses name	No. of tested plants	Reaction		Expected ratio	X^2	P value
			R	S			
1	Sakha 93 x Gemmeiza 9	337	179	158	9 : 7	1.34	0.05
2	Sakha 8 x Giza 168	294	175	119	9 : 7	1.67	0.05
3	Giza 163 x Sids 1	349	143	206	7 : 9	1.09	0.05
4	Giza 163 x Sakha 93	345	200	145	9 : 7	0.41	0.05

Susceptible x Resistant parents

Table (2) presents the frequency distribution of parents, F_1 and F_2 populations of the three susceptible x resistant crosses (Sakha 8 x Giza 168, Giza 163 x Sids1 and Giza 163 x Sakha 93) for seedling reaction to stripe rust. Data showed that the susceptible parent Sakha 8 practices high susceptibility according to the scale adopted by Stakman *et al* (1962). On the other hand, the 39 plants of the second parent, Giza168 expressed resistant reaction. According to the same scale, the 15 F_1 plants were susceptible. Reaction of the F_2 plants ranged from susceptible to resistant. Numbers of susceptible, intermediate and resistant plants were 92, 27 and 175, respectively. The phenotypic classes fitted the expected ratio 9: 7 with P. value = 0.05 (Table 3) indicating the presence of two complementray dominant genes.

In the cross Giza 163 x Sids1, the infection types of both parents (Sids1 and Giza 163) were all susceptible. Also, 17 F_1 plants of the same cross were susceptible. The F_2 plants showed that number of resistant, intermediate and susceptible plants were 143, 18 and 188, respectively, fitting a theoretical ratio of 7: 9 with P. value = 0.05 (Table 3) indicating the presence of two complementray recessive genes.

The behavior of the last cross Giza 163 x Sakha 93 was presented in Table (2). The susceptible parent Giza 163 practices high susceptibility since the 28 tested plants were all susceptible. While, the 35 plants of the second parent, Sakha 93, expressed resistant reaction to stripe rust. All the 12 F_1 plants were shown resistant. The F_2 plants showed that the numbers of resistant, intermediate and susceptible plants were 200, 31 and 114, respectively. Data presented in Table (3) fitted theoretical segregation ratio of 9: 7 with P.value = 0.05 indicating the presence of two complementary dominant genes controlling resistance to stripe rust. These results are in agreement with those reported by Chen and Line (1993) who reported the presence of two pairs of genes with complementary interaction and F_2 segregation ratio was 9: 7.

Adult plant tests in field

Field tests were carried out to study the inheritance of resistance to stripe and leaf rusts at the adult stage under natural infection. The field tests were applied to the four crosses using the (P_1, P_2, F_1 and F_2) populations of each of the four crosses previously investigated at the seedling stage.

The natural infection by stripe and leaf rust diseases in field was high during the season of testing and allowed successful assessment.

Stripe Rust

Resistant x Resistant parents

Reaction type of both parents of the first cross (Sakha 93 x Gemmeiza 9) were R expressing their resistance to stripe rust and reaction type of the 15 F_1 plants was R expressing the resistant phenotype. (Table 4). Number of resistant and susceptible plants were 285 and 22, respectively. This frequency fitted the theoretical expected ratio of 15: 1 with P. value = 0.05 (Table 5) indicating the functioning of two dominant genes controlling the stripe rust resistance in this cross.

Table 4. Frequency distribution of reaction type of parents, F_1 and F_2 populations of four crosses at adult stage against natural field infection with stripe rust.

Cross No.	Cross	No of tested plants	Types of infection					
			0	R	MR	M	MS	S
1	Sakha 93 x Gemmeiza 9							
	P_1	17		17				
	P_2	22		22				
	F_1	15		15				
	F_2	307	97	170	13	5	7	15
2	Sakha 8 x Giza 168							
	P_1	14						
	P_2	18		18				
	F_1	18		18				
	F_2	284	41	104	34	16	20	69
3	Giza 163 x Sids 1							
	P_1	11						
	P_2	11		11				
	F_1	14		14				
	F_2	239	27	103	26	4	6	73
4	Giza 163 x Sakha 93							
	P_1	16						16
	P_2	15		15				
	F_1	18			18			
	F_2	243	67	101	17	7	10	41

Resistant x Susceptible parents

Data presented in Table (4) indicated that in the second cross Sakha 8 x Giza 168, wheat cultivar Sakha 8 (P_1) consistently expressed susceptibility to stripe rust (S). On the other hand, Giza 168 (P_2) showed resistance (R). The reaction of the 18 F_1 plants of this cross was R expressing the resistant phenotype. The F_2 reaction types ranged from 0 to S (Table 4). Number of resistant and susceptible plants were 195: 89, respectively. That numbers fitted the theoretical expected ratio of 9: 7 with P. value = 0.01 indicating the presence of two complementary dominant genes (Table 5) controlling resistance to stripe rust in this cross.

Susceptible x Resistant parents

Infection type of Giza 163 (P_1) of the third cross (Giza 163 x Sids1) was susceptible(S) to stripe rust, while Sids1 (P_2) showed resistance(R). The reaction type of the 14 F_1 plants of the same cross was R expressing the resistant phenotype. The F_2 reaction types ranged from 0 to S (Table 4). Numbers of resistant and susceptible plants were 180 and 59, respectively. These numbers fitted the theoretical expected ratio of 3: 1 with P. value = 0.05 indicating that only one dominant gene controls the stripe rust resistance in this cross (Table 5).

Table 5. Phenotypic classes of F_2 population of four crosses under natural field infection with stripe rust at adult stage.

Cross No.	Cross	No. of tested plants	Reaction R	Reaction S	Expected ratio	X^2	P value
1	Sakha 93 x Gemmeiza 9	307	285	22	15 : 1	1.356	0.05
2	Sakha 8 x Giza 168	284	195	89	9 : 7	5.29	0.01
3	Giza 163 x Sids 1	239	180	59	3 : 1	0.0181	0.05
4	Giza 163 x Sakha 93	243	192	51	15 : 1	2.080	0.05

In the fourth cross (Giza 163 x Sakha 93), the reaction type of the second parent (Sakha 93) was R to stripe rust, while reaction type of the first parent showed susceptibility. The 18 F_1 plants had MR reaction expressing the resistant phenotype and indicating dominance of resistance over susceptibility (Table 4). The F_2 reaction types ranged from 0 to S (Table 5). Number of resistant and susceptible plants were 192 and 51, respectively. These frequencies fitted the theoretical expected ratio of 3 : 1 with P. value = 0.05 indicating that only one dominant gene is controlling the stripe rust resistance in this cross (Table 5).

These results are in agreement with that reported by Singh (1992) who found that at least one resistance gene was common and displayed adult plant resistance to stripe rust.in Mexico.

Leaf Rust

Susceptible x Resistant parents

Reaction type of Sakha 93 (P_1) of the first cross (Sakha 93 x Gemmeiza 9) was S to leaf rust, reaction type of Gemmeiza 9 (P_2) was R, while reaction type of the 15 F_1 plants was S expressing susceptibility to leaf rust (Table 6). The F_2 infection types ranged from 0 to S (Table 6). Number of resistant and susceptible plants were 125 and 59, respectively. This frequency fitted the theoretical expected ratio of 3: 1 with P. value = 0.025 indicating that only one dominant gene is controlling the leaf rust resistance in this cross (Table 7). Similar findings was obtained by Dyck (1991) that one gene pair segregating for reaction in F_2 population (3: 1).

Table 6. Frequency distribution of reaction type of parents, F_1 and F_2 populations of four crosses at adult stage against natural field infection with leaf rust.

Cross No.	Cross		No of tested plants	Types of infection					
				0	R	MR	M	MS	S
1	Sakha 93 x Gemmeiza 9								
		P_1	17						17
		P_2	22		22				
		F_1	15						15
		F_2	184	63	18	29	15	7	52
2	Sakha 8 x Giza 168								
		P_1	14						14
		P_2	18		18				
		F_1	18						8
		F_2	277	6	2	1	9	7	12
3	Giza 163 x Sids 1								
		P_1	11						11
		P_2	11						11
		F_1	14						14
		F_2	317	9	6				194
4	Giza 163 x Sakha 93								
		P_1	16						6
		P_2	15						5
		F_1	18						8
		F_2	240	8	2	4	3	1	02

Table 7. Phenotypic classes of F_2 population of four crosses under natural field infection with leaf rust at adult stage

Cross No.	Cross	No. of tested plants	Reaction		Expected ratio	X^2	P value
			R	S			
1	Sakha 93 x Gemmeiza 9	184	125	59	3 : 1	4.89	0.025
2	Sakha 8 x Giza 168	277	148	129	9 : 7	0.896	0.05
3	Giza 163 x Sids 1	317	123	194	7 : 9	3.154	0.05
4	Giza 163 x Sakha 93	240	34	206	3 : 13	3.300	0.05

Data presented in Table (6) showed also that the wheat cultivar Sakha 8 consistently expressed susceptibility to leaf rust with infection type S in the second cross (Sakha 8 x Giza168). On the other hand, Giza168 (P_2) showed resistant with reaction type R .The reaction type of the 18 F_1 plants of this cross was MS. The F_2 reaction types ranged from 0 to S (Table 6). Number of resistant to susceptible plants were 148: 129, respectively. These numbers fitted the theoretical expected ratio of 9: 7 with P. value = 0.05 indicating the presence of two complementary dominant genes (Table 7) controlling resistance to leaf rust in this cross.

These results were similar to those reported by Ezzahiri and Roelfs (1989), who indicated that adult plant resistance to leaf rust in wheat; cv. Era; was found to be conferred by two complementary genes.

Susceptible x Susceptible parents

Infection type of two parents of the third cross (Giza 163 x Sids1) showed susceptible phenotypes(S) to leaf rust and so did the 14 F_1 plants of the same cross (Table 6).The F_2 reaction types ranged from 0 to S. Number of resistant and susceptible plants were 123 and 194, respectively. These numbers fitted the theoretical expec.ed ratio of 7: 9 with P. value = 0.05 indicating the presence of two complementary recessive gene (Table 7).

Infection type of the two parents of the fourth cross (Giza 163 x Sakha 93) were also S and similar type occurred by the 18 F_1 plants (Table 6). The F_2 reaction types ranged from 0 to S. Number of resistant and susceptible plants were 34 and 206, respectively. This frequency fitted the theoretical expected ratio of 3: 13 with P. value = 0.05 indicating that there are one dominant gene and one recessive gene with complementary interaction for resistance to leaf rust (Table 7).

The previous results are in agreement with that reported by Abd El-Latif *et al* (1995), who indicated that each of the cultivars Giza 164 and Sakha 62 had two resistance genes to leaf rust resistance while Sakha 61 had no genes. On the other hand, Yadav *et al* (1992) observed transgressive segregation for leaf rust for both resistance and susceptibility in the F_2 population and field resistance was found to be partially dominant, being controlled by three or possibly more genes.

Acknowledgement: ***The authers like to deeply appreciate the kind and fruitful help and advice of dr. Salah Abol-Naga and Dr. A. A. Basioni, Wheat Dis. Division, Sakha Agric.Res. Station, ARC.***

REFERENCES

Abd El-Latif, A. H., T. M. Shehab El-Din, M. M. El-Shami and S. A. Abouel-Naga (1995). Genetic of *Triticum aestivum*: *Puccinia recondita tritici* interaction "in three Egyptian wheat cultivars" J. Agric. Res. Tanta Univ., 21 (1): 182-189.

Chen, X. M. and R. F. Line (1993). Genes for resistance to stripe rust in 'Tres' wheat. Crop Science 32: 3, 692-696. .

Dyck, P. L.(1991). Genetics of adult plant leaf rust resistance in Chinese Spring and Sturdy wheats . Crop. Sci. 31: 309-311.

Ezzahiri, B. and A. B. Roelfs (1989). Inheritance and expression of adult plant resistance to leaf rust in Era wheat. Plant Disease 73: 549-551.

Shehab El-Din , T. M. and A. H. Abd El-Latif (1996). Quantitative determination of the gene action of stripe rust resistance in a 6-parent daillel cross of wheat. J. Agric. Sci. Mansoura Uni., 21(10): 3461-3467.

Shehab El-Din , T. M., M. M. El-Shami and A. H. Abd El-Latif (1996). Quantitatve and qualitative genetic studies on *Triticum aestivum*:*Paccinia rcondita* interaction. J. Agric. Sci. Mansoura Uni., 21(11): 3769-3778.

Singh, R.P.(1992). Genetic association of leaf rust resistance gene L34 with adult plant resistance to stripe rust in bread wheat. Phytopathology. 82 (8): 835-838.

Stakman, E. C., D. M. Stewart and W. Q. Loegering (1962). Identification of physiologic races of Puccinia graminis tritici. ARS, USDA. Agr. Res. Serv. Bull. E-617. 53pp.

Stubbs, R. W., J. M. Prescott, E. E. Saari and H. J. Dubin (1986). Cereal Disease Methodology Manual. Centro Internacional de Mejoramiento de Maiz Y Trigo (CIMMYT). Mixico pp. 22.

Yadav, B., B. Bam, S. K. Sethi and O. P. Luthra (1992). Genetics of field resistance and transgressive segregation to leaf rust of wheat. Cereal Research Communieations. 20: 1-2, 41-48.

توارث ألمقاومه لمرضي الصدأ الأصفر وصدأ الأوراق في ست أباء وهجنها في قمح الخبز

عبدالعزيز جلال عبدالحافظ[1]، محمود ألهيتي[1]، عبداللطيف حسين عبداللطيف[2]
عبدالواحد عبدالحميدالسيد محمد[1] و ثناء حمدعبدالكريم[2]

١ قسم المحاصيل، كلية الزراعه-جامعة كفرالشيخ
٢ قسم بحوث القمح، معهد بحوث المحصيل ألحقليه، سخا- مركزالبحوث الزراعيه

تمت هده الدراسة بمعمل زراعة الأنسجة بقسم المحاصيل كلية الزراعة بكفر الشيخ جامعة طنطا و المزرعة البحثية لمحطة البحوث بسخا مركز البحوث الزراعية، خلال الفترة من 1999 و حتى 2003 وذلك بهدف دراسة طبيعة وراثة مرضى الصدأ المخطط أو الأصفر و صدأ الأوراق في ست أصناف من قمح الخبز و ألهجن الناتجة منها وذلك في الصوبه(البادرات) والحقل(النباتات ألبالغه).

أظهر تحليل المقاومه لمرض الصدأ المخطط فى طور البادرة فيالصوبه على وجود عاملين وراثيين سائدين مكملين التأثير يتحكمان فى صفة المقاومه لمرض الصدأ المخطط (الأصفر) فى كل الهجن المختبرة ما عدا الهجين جيزة 163 × سدس1 كان به عاملين وراثيين متنحيين مكملين التأثير يتحكمان فى هده الصفة. أكد تحليل المقاومه لمرض الصدأ المخطط فى طور النبات البالغ تحت ظروف العدوي الطبيعيه بألحقل على وجود زوجين من العوامل السائده يتحكمان فى صفة القاومه للصدأ المخطط فى الهجين سخا 93 ×جميزة 9. بينما دلت النتائج على وجود عاملين مكملين التأثير سائدين يتحكمان فى وراثة صفة المقاومة فى الهجين سخا 8×جيزة 168 وعامل وراثي واحد سائد يتحكم في صفة المقاومة للمرض فى كل من الهجينين جيزة 163× سدس1 و جيزة 163 ×سخا 93 .

كما أظهر تحليل المقاومه لمرض صدأ الأوراق فى طور النبات البالغ تحت ظروف العدوي الطبيعيه بألحقل علىوجود عامل واحد سائد يتحكم فى صفة المقاومة لصدأ الأوراق فى الهجين سخا 93 × جميزة 9.

بينما دلت النتائج على وجود عاملين سائدين مكملين فى الهجين سخا 8 × جيزة 168 وعاملين متنحيين مكملين التأثير فى الهجين جيزة 163 × سدس1 يتحكمان فى وراثة صفة المقاومة لصدأ الأوراق. وعلىالجانب الأخر يوجد عامل واحد سائد و عامل واحد متنحى مكملين التأثيريتحكمان فى صفة المقاومة للمرض فى الهجين جيزة 163 × سخا 93.

مجلد المؤتمر الخامس لتربيه النبات – الجيزه٢٧ مايو ٢٠٠٧
المجله المصريه لتربية النبات ١١(١): ٤١١-٤٢١ (عدد خاص)