20- Wellings, C. R.; R. P. Sing; R. A. McIntosh and A. Yahyaoui (2000). The assessment and significant of pathogenic variability in *Puccinia striiformis* in breeding for resistance to stripe (yellow) rust:Australian and International Studies. Pages 134-143. In:Proceeding of the 11th Regional Wheat Workshop for Eastern, Central and Southern Africa. September 18-22, 2000, Addis Ababa, Ethiopia.

21- Wilcoxson, R. D. and E. E. Saari, Eds (1996). Bunt and Smut Diseases of Wheat:Concepts and Methods of Disease Management, Mexico, D. F.:CIMMYT.

22- Zadoks, J. C. and C. F. Konzak (1974). A decimal code for growth stages of cereals. Eucarpia Bull.7. p.12.

تطوير صنف حنطة خبز (بابل ١١٣) في العراق

محمد عبد الخالق الحمداني أياد حسن كاظم

حسن عبد الواحد عباس حسن يوسف جابر

الملخص

استحدث عام ١٩٩١ برنامج تربية طويل أستهدف تطوير صنف حنطة خبز مقاوم لمرضي التفحم اللوائي والصدأ الأصفر. استخدم المصدر R-23 كواهب لصفة المقاومة ضمن برنامج تربية مع الصنف مكسيباك. وظفت طريقة حفظ النسب في برامج العزل والانتخاب ابتداءً من الجيل الثاني. خضعت نباتات الأجيال المتعاقبة إلى الانتخاب المستمر تحت ظروف التلويث الاصطناعي. استخدمت طريقة سريعة ودقيقة في غربلة هجن الأجيال الثلاثة المتعاقبة (الثالث-الخامس) لمرض التفحم اللوائي تحت ظروف مثالية لحدوث وتطور الإصابة. خضعت تلك الهجن إلى برامج الغربلة والانتخاب لمرض الصدأ الأصفر تحت ظروف التلويث الاصطناعي في الحقل. أنتخب أحد عشر هجينا واعدا من بين ١٥٢ خطاً في نهاية الجيل الرابع اعتمادا على مقاومتها مرض الصدأ الأصفر. أدخلت الهجن المنتخبة في دراسة تقويمية لمعرفة سلوكها لأمراض التفحم اللوائي والتفحم المغطى والصدأ الأصفر إضافة إلى تقييس عدد من عوامل الإنتاجية. شخص التركيب الوراثي ١١٣ (بابل ١١٣) كأفضل هجين من حيث الإنتاجية والمقاومة. أثبت بابل ١١٣ تفوقاً عالياً على الصنف المعتمد تموز ٢ في الإنتاجية والمقاومة والمواصفات الزراعية. سجل الصنف بابل ١١٣ واعتمد في العراق من قبل اللجنة الوطنية لتسجيل واعتماد الأصناف الزراعية / وزارة الزراعة بموجب القرار ١٩ في ٢٠٠٠/١١/١١.

دائرة البحوث الزراعية وتكنولوجيا الغذاء – وزارة العلوم والتكنولوجيا – بغداد، العراق

4- Al-Hamdany, M. A. and H. N. Al-Noaimi (1999). The activity of furfural to control the causal agent of wheat flag smut *Urocystis agropyri*. Iraqi J. Agric., 4:164-176.

5- Al-Hamdany, M. A.; M. M. Salih; A. H. Kadhem; H. A. Abas; F.O. Saleem and N. R. Shraida (1998). Fast method for screening wheat genotypes to flag smut. Iraqi J. Agric., 3:28-34.

6- Al-Maroof, E. M. (1997). Role of varietal mixtures in disease control of *Puccinia striiformis* in Iraq. Ph. D Thesis, Baghdad Univ., p.132.

7- Anonymous (1977). Compendium of Wheat Diseases. Am. Phytopath. Soc. Edit. M. V. Wiese. p.106.

8- Ballantyne, B. (1993). Reaction of wheat varieties to flag smut in Southern New South Wales. Plant Disease Survey, Austral. Plant Path. 22:100-104.

9- Coakley, S. M. and R. F. Line (1981). Quantitative relationships between climatic variables and stripe rust epidemics on winter wheat. Pytopathology, 71:461-467.

10- El-Naimi, M. and O. F. Mamluk (1995). Rusts dispersal in Syria and their causal agents virulence. Arab J. Pl. Prot. 13:76-81.

11- Johnson, R. (1992). Reflections of plant pathologist on breeding for disease resistance with emphasis on yellow rust and eyespot of wheat. Plant Pathology, 41:239-254.

12- Majeed, H. A.; H. Y. Al-Ani; A. H. El-Behadlii and M. Majeed (1979). Flag smut on wheat. II. Identification of physiological races and varietal resistance of wheat cultivars. Iraqi J. Agric. Sci., 14:3-14.

13- Mamluk, O. F. (1992). Seedborne diseases of wheat and barley. Pages 40-47. In: Proceeding of Workshop on Quarantine for Seed in the Near East Region. FAO/ICARDA/DGISP, 2-9 November 1991. Aleppo, Syria.

14- Mamluk, O. F.; M. El-Naimi and M. S. Hakim (1996). Host preference in *Puccinia striiformis* f. sp. *tritici*. Pages 86-88. In:Proceeding of the 9th European and Mediterranean Cereal Rusts and Mildews Conference. September 2-6, 1996, Luntern, The Netherlands.

15- Mamluk, O. F.; M. Singh; M. El- Naimi; A. Saleh, and I. Maaz (1996). Crop losses due to yellow rust. Pages 13-15. In:Annual Report of ICARDA, Pathology Section. p.19.

16- Mustafa, F. H. (1974). List of Plant Diseases In Iraq. Ministry of Agriculture and Agrarian Reform Bull. No., 74, p.14.

17- Roelf, A. P.; R. P. Sing; E. E. Saari (1992). Rust Diseases of Wheat: Concepts and Methods of Disease Management, Mexico, D. F. CIMMYT. p.81.

18- Platz, G. J. and R. G. Rees (1980). Flag smut resistance in selected wheat cultivars and lines. Queensland J. Agric. Animal Sci., 37:141-143.

19- Saari, E. E. and J. M. Prescott (1985). World distribution in relation to economic losses. Pages 280-281. In:The Cereals Rusts II. 1985. Roels A. and W. R. Bushnell (Editors). Academic Press, Incorporation.

Total Protein in the Flour: 10.8%.
Adsorption based on 14% moisture: 61.6
Maturity Period: 4.25 mn.
Stability Period: 5.5 mn.

Table 6:A comparison test between Babil 113 and Cultivar Tamoz 2.

Agronomic Traits	Babil 113	Tamoz 2
Tillers/1 m	130 a	125 b
Tillers/Plant	4-5	4-5
Length of Spike without awn (cm)	12-16	10-13
Seeds/Spike	68-75	68-73
Weight of 1000 seeds (gm)	48 a	36.9 b
Seeds weight of 50 spikes (gm)	154 a	126 b
Productivity (Kg)		
1 m^2	0.750 a	0.566 b
4 m^2	2.816 a	2.246 b
35m^2	19.30 a	13.5 b
Disease Responses		
Flag Smut	R	HS
Yellow Rust	R	MR

Each number was the mean of four replicates.
Means have similar letters in the same row are statically not different.

Table 7:Yield trails of Babil 113 and Tamoz 2 wheat cultivars in Twaitha and Latifyia Stations in 99-2000 season

Unit Area $(m)^2$	Yield (Kg)			
	Tuwaitha		Latifyia	
	Babil 113	Tamoz 2	Babil 113	Tamoz 2
1	0.629 a	0.540 b	0.498 a	0.378 b
40	26.10 a	21.60 b	19.65 a	15.00 b
60	36.90 a	32.30 b	29.70 a	19.50 b
150			74.10 a	56.83 b
2500	1350.60 a	961.1 b	1200.52 a	993.30 b

Babil 113 significantly approved to be a candidate for registration and release as a new bread wheat cultivar in Iraq. The late sowing (2nd week of December) is quite suitable for high productivity. National Committee For Registration and Release of Agricultural Varieties registered and released this new cultivar (Babil 113) in Resolution No.19 0n 11/11/2000.

REFFERANCES

1- Al-Beldawi, A. S. and E. Jawad (1987). Susceptibility of some wheat cultivars to flag smut and its chemical control. Pages 1520-1524. In: Proceeding of 4th Congress of Scientific Research Council. Baghdad, Iraq.

2- Al-Beldawi, A. S.; E. Jawad and T. M. Ali (1996). Identification of physiological specialization in the causal agents of leaf and black stem rust on wheat. Iraqi J. Agric., 1:61-69.

3- Al-Hamdany, M. A.; C. R. Wellings; H. Y. Jaber and H. A. Abas (2002). Virulence pattern of yellow rust causal agent *Puccinia striiformis* Westend. on Near Isogenic Lines in Baghdad area. Arab J. Pl. Prot., 20:24-28.

confirmed in three consecutive generations (F7-F9). The yield of the new cultivar ranged from 3500 to 5388 Kg./h compared to 2324 to 3680 Kg./h in Mexipak (Table 5).

Table 4:Disease response and agronomic traits of the new wheat cultivar (Babil 113) in a comparison with Mexipak during F6 season

Agronomic Traits	Babil 113	Mexipak
Plant height (cm)	105	103
Spike length without awn	14	12
Stem diameter (mm)	5	4
Tillers/plant	7	3-4
Nodes/tiller	6	5
Weight of 1000 seeds (gm)	47.6	34.1
Seeds weight of 50 spikes (gm)	86.6	72.0
Disease Responses		
Flag Smut	R	S
Bunt	R	MS
Yellow Rust	R	S

Table 5:Productivity of new cultivar Babil 113 during three consecutive generations (F7-F9) in a comparison with Mexipak cultivar

Unit Area m^2	Kg/ unit area		Kg/h		Percent Increment over Mex.
	Babil 113	Mexipak	Babil 113	Mexipak	
1 (F7)	0.522	0.328	5226.0	3280.0	60
1 (F8)	0.539	0.368	5388.0	3680.0	47
200 (F7)	76.0	53.7	3800.0	2680.8	42
650 (F8)	262.6	171.1	4040.0	2732.4	48
2500 (F9)	870.0	581.0	3480.0	2324.0	50

The productivity was calculated from three replicates in 1and 200m^2 in F7, 1 and 650m^2 in F8 and 2500m^2 in F9 seasons.

A comprehensive comparison test between the new cultivar and the landrace cultivar Tamoz 2 indicated that Babil 113 was significantly surpassed Tamoz 2 in the following traits: number of tillers per 1m length, spike length, weight of 1000 seeds, seed weight of 50 spikes, and finally the yield in 1, 4, and 35m^2 (Table 6). Moreover, the host reaction of both cultivars to flag smut and yellow rust indicated that Tamoz 2 has susceptible reaction to flag smut which reflected in 76.15% infection while host reaction of Tamoz 2 expressed moderate resistance compared with resistant reaction in Babil 113.

In 99-2000 seasons, productivity trails in Tuwaitha and Latifiyia Experimental Stations revealed similar results (Table 7). The evaluation tests of Babil 113 flour indicated that the cultivar met the optimum requirements for registration and release. However, results of flour quality of wheat cultivar Babil 113 showed the following traits:

Extract percent: 85%.
Grain moisture before grains moisten: 9.4%.
Flour moisture: 13.2%.
Moist Gluten based on 14% moisture: 22.7
Dry Gluten based on 14% moisture: 7.5
Ash based on Dried material: 1.2107

The productivity of these selected hybrid lines in F5 was significantly surpassed Mexipak cultivar. The percentages of yield increments over Mexipak in field plots of 13.5 m^2 were ranged from 23.7 in 49-2 to 56.5% in 113. Yield of 1m^2 of all selected hybrids except 116 surpassed Mexipak by 10.3 to 68.6% (Table2). Data of host reactions against yellow rust revealed that 49-5, 95-1,306A, and 446 showed highly resistant reactions while resistant reaction was observed on the plants of 45-1, 113, 292, 312 and 401. Two hybrid lines namely 49-2 and 116 were selected because their plants showed highly resistant reactions to flag smut and bunt diseases in 116. For bunt, all the selected lines except 45-1, 49-2 and 292 showed resistant reactions. Disease response of their parents, in contrary R-23, Mexipak showed susceptible reactions to flag smut, bunt and yellow rust diseases (Table 3).

Table 3: Disease responses for flag smut, bunt and yellow rust in hybrid-selected lines following artificial inoculations in F5 season

Hybrid lines	Disease Responses [1]		Yellow Rust [3]	
	Flag Smut [2]	Bunt [2]	Disease Severity (0,2,5, 8)	Disease Response
45-1	HS	MR	2	R
49-2	HR	MR	5	MR
49-5	HR	HR	0	HR
95-1	R	MS	0	HR
113	R	R	2	R
116	HR	HR	5	MR
292	HS	MR	2	R
306A	HR	HR	0	HR
312	R	HR	2	R
401	HS	R	2	R
446	MS	R	0	HR
Mexipak	HS	MS	8	S
R-23	HR	HR	2	R
Saber beg	MS	S	8	S

1- Seeds were inoculated with mix population of *Urocystis agropyri* and planted in the first week of November, while teliospores of *Tilletia caries* were used to inoculate the seeds for bunt disease. Bunt trail was conducted in the third week of December.

2- Disease incidence was considered for disease response where HR=no symptoms, R=incidence from 1 to 10%, MR=incidence from 11 to 20%, MS=incidence from 21 to 30%, S=incidence from 31 to 40%, and HS= incidences were more than 40% (5).

3- Disease severity was measured according to modified Cobb scale by Line (7).

Based on disease resistance against the three diseases, although 49-5, 113, and 306 A represented the best hybrid lines. Yield potential and some agronomic traits such as lodging and shattering resistance led to select the genotype 113 in the end of F5 season . This hybrid line called Babil 113 as a new bread cultivar. In contrary to Mexipak cultivar, the new cultivar Babil 113 characterized by resistant reaction along with good agronomic traits during F6 (Table 4). The high productivity of Babil 113 was significantly

following generations, each selected plant was coded. For yellow rust, grades of disease severity ranged from 1 to 9 on line scale (7).

4. Screening for disease resistance in the following generations:

Out of 247 F3 hybrid lines, 152 lines were selected in the end of F3 season. The plants of most these lines showed resistance to moderate resistance reactions to yellow rust and flag smut under field conditions. In order to avoid any chance of disease escape in flag smut (4), evaluation test of disease response under growth room conditions on 152 hybrid lines resulted in a successful designation of highly resistant genotypes. Based on the disease incidences recorded on the 3rd and 4th leaf stages of wheat seedlings, the genotypes tested could be grouped as follows:

28 lines with highly resistant reaction to *U.agropyri* (HR) with no symptoms at all.
14 lines having resistant reaction (R) with 1to10% incidence.
17 lines with moderate resistance (MR) with 11 to 20% incidence.
23 lines with moderate susceptible (MS) with 21 to 30% incidence.
40 lines showed susceptible reaction (S) with 31 to 40% incidence.
30 lines with highly susceptible reaction (HS) with more than 40% incidence.

Disease responses of the parents Mexipak and R-23 reflected highly susceptible and highly resistance reactions respectively. Nevertheless, considering the yellow rust as the most important screening factor in the final selection, 11 hybrid lines namely 45-1,49-2, 49-5, 95-1, 113, 116, 292, 306A, 312, 401, and 446 were selected in the end of F4 season. Selection of these lines based on the following traits: resistance or moderate resistances to yellow rust and flag smut and Plant vigor.

Table 2:Preliminary evaluation of productivity of selected hybrid lines (Mex.XR-23) in F5 season

Hybrid lines	Productivity (Kg.) in		Percent increment over Mex. Cultivar[3]
	$1m^2$	Plots of 13.5 m^2 [1,2]	
45-1	0.410[1]	4.310	24.1
49-2	0.400	4.306	23.7
49-5	0.429	4.459	28.3
95-1	0.439	5.199	49.5
113	0.547	6.147	56.5
116	0.337	4.377	25.0
292	0.495	5.108	46.9
306A	0.467	5.267	51.5
312	0.540	4.601	32.4
401	0.457	4.719	35.7
446	0.532	4.906	41.1
Mexipak	0.376	3.476	-
R-23	0.280	2.560	-
LSD 0.05	0.135	1.10	-

1.Each number represents the means of three replicates.
2.Seeds were planted as lines (3m length, and 25cm between lines inside the plot.
3. Percentages based on the yield of $13.5m^2$

selected, R-23 was chosen as a resistance donor in this breeding program because of its agronomic traits such as long spikes, stout stem, large seed and shattering resistance.

Table 1:Host reactions of wheat genotypes against flag smut and yellow rust causal agents following artificial inoculations under field conditions.

Wheat Genotypes	Disease Incidences of flag smut using 3 isolates			Disease Severity of Yellow Rust	
	Suwaira	Rabeaa	Rashidiya		
Cultivars				Grades	
Saber beg	0.0	33.4	29.5	8	S
Mexipak	63.4	49.2	46.1	8	=
Araz	58.6	42.8	17.1	8	=
Inia 66	16.2	8.2	16.2	8	=
Abu-Ghraib 3	20.6	45.9	46.3	8	=
Abu-Ghraib 4	45.5	42.3	20.2	8	=
Ajeeba	39.7	13.7	25.5	8	=
Nuri 70	39.0	66.3	57.4	8	=
Iratom	34.5	29.6	11.10	8	=
Hybrids					
Saber X Mexipak(SM)	18.7	48.9	40.0	8	S
Saber X Araz(SA)	17.7	41.7	39.8	8	=
Mex.X Sab.XAbu3(MSAB3)	22.6	38.1	48.3	8	=
Mex.XSab.XAbu4(MSAB4)	27.7	37.5	24.1	8	=
Variants					
802	8.4	30.1	33.8	8	=
336	20.4	17.6	14.1	8	=
337	16.5	21.6	13.8	8	=
749	0.0	42.1	49.0	8	=
Strains					
M-17	6.5	34.1	29.3	8	=
M-27	0.0	28.4	33.7	8	=
M-94	18.7	58.3	46.7	8	=
R-23	0.0	8.3	7.7	2	R
R-24	0.0	7.3	13.5	2	=
250	7.4	12.1	13.1	5	MR.
LSD P= 0.05	9.4	7.0	7.6		-

Percentages of flag smut were transformed to ARCSIN before statistically analyzed.
Disease severity of yellow rust based on the Cobb modified scale by Line where grade 2 = resistance, grade 5= moderate resistance or susceptible based on sporulation and the chlorosis, grade 8 = susceptible reaction (7).

2. First generation of the program:

The F1 plants of Mexipak X R-23 characterized by having some traits of R-23 such as brown seeds, long spikes, large seeds, stout stems and shattering resistance. However some of Mexipak traits were observed also in F1 plants such as spike color and tillers/plant.

3. Inheritance nature of flag smut resistance in R-23:

Results of resistance inheritance for flag smut in the genotype R-23 indicated that two gene pairs could be conditioned flag smut resistance with epistasis in nature. The infected and healthy F2 plants were significantly matched the segregation ratio 9:7 respectively with high probability. In the field, although there were no high disease incidences on F2 progenies, 247 plants were selected individually. Meantime, all plants having high susceptible reactions to both diseases and those having undesirable traits were excluded from F2 progenies. In order to trace each plant in the

symptoms), R=resistance (Incidence is less than 10%), MR=moderate resistance (Incidence is less than 20%), MS=moderate susceptible (Incidence is less than 30%), S=susceptible reaction where the incidence is less than 40%, while highly susceptible reaction (HR) reflected more than 40% Infection in any hybrid line (5). For yellow rust, the infection types were enumerated using a basic scale (0, 2, 5, 8) where 0=no visible signs or symptoms (HR), 2=(Resistant) necrotic and/or chlorotic areas, with trace sporulations (R), 5=(intermediate) either moderate resistance or moderate susceptible, with light or medium sporulations (MR or MS), 8=(Susceptible) abundant sporulation without necrosis or chlorosis (S) according on the modified Cobb scale by Line (7). The disease severity was calculated during the dough stage (Stage 8 on Zadok scale) (22). Final selection was conducted in the harvesting time of F5.

During F6 season, the new selected genotype (Babil 113) with the commercial cultivar Mexipak were thoroughly investigated during three consecutive generations (F7-F9) in Tuwaitha Experimental Station for yield potential in areas of 1, 200, 650 and 2500m^2. National Committee of Registration and Release of Agricultural Cultivars in Iraq requested to run a comparison test in the productivity and some agronomic traits between the new cultivar (Babil 113) and the well known released wheat cultivar Tamoz 2. Field trails for this requested test were conducted in two locations namely Tuwaitha and Latifiya Stations during 98-99 and 99-2000 seasons. Finally, as apart of cultivar release requirements, quality tests of cultivar flour were undertaken by the Department of Quality Control in The General Company of Grain Industry/Ministry of Trade.

The new cultivar was applied for registration and release in Iraq.

RESULTS AND DISCUSSION

1. Searching for disease resistance:

In spite of using three sources of inoculum units of *U. agropyri*, a clear confirmation of pathogen diversity as reported (1, 12) was existed in this test. Out of the tested genotypes, three of them namely R-23, R-24 and 250 showed resistant reactions against the three isolates (Table 1). Therefore, these genotypes could be utilized in any breeding program to improve flag smut resistance in Iraq. Considering yellow rust resistance in this breeding program, all the genotypes except R-23, R-24 and 250 successfully approved their resistant reactions against mixed populations of *P.striiformis*. Disease severity based on Cobb modified scale by Line (7), were grade 2 for R-23 and R-24, which reflected the resistant reaction (R). The genotype 250 showed moderate resistance (MR) (grade 5). Symptoms of grade 2 either in R-23 or R-24 plants represents scattering necrotic striate lines with or without small tiny pustules. In contrary to these genotypes, grade 8 which reflected the susceptible reaction (S) was observed on all other tested genotypes. Considering disease resistance and agronomic traits in the source to be

Saber beg cultivar which were collected from the previous season and stored at freeze condition.

2. First generation of the program:

A cross between the commercial wheat cultivar Mexipak (highly susceptible to flag smut and yellow rust) and the resistant source R-23 was conducted. Seeds of F0 were collected in spike wise and planted individually with both parents in JV 7. Ten days later, the seedlings of F1 plants were transplanted in the field. All observations on F1 plants were taken. At the end of season, the seeds of F1 plants were collected for further generations.

3. Inheritance nature of flag smut resistance in R-23:

In order to study the inheritance nature of flag smut resistance in R-23, an experiment was conducted under growth room conditions (20°C with 12hr photoperiod). One hundred and fifty Seeds from R-23, Mexipak and F1 plants were inoculated with a mix population of teliospores of *U. agropyri* (0.5 g spores/100 g seeds) and planted in wet soil in three replications (4, 5). Healthy and infected seedlings were counted during the 3rd, 4th and 5th leaf stages of the seedlings for disease incidences. Statistical analysis using Chi-square test was used to test the segregation ratio of host reaction in F2.

In the field, seeds of all F1 plants were inoculated with a mix population of teliospores of *U. agropyri* and planted in three days pre-irrigated field plots in the first week of November at Tuwaitha Experimental Station. At heading stage, all the plants were artificially inoculated with urediospores suspension of *P. striiformis*. In order to create favorable conditions for infection and disease development, the infections were established early on saber beg plants which used as a spreader rows. Pedigree method was adapted in screening and selection procedures. Selection for rust resistance was started when the disease severity on Saber beg was 100S which reflected grade 8 of Line scale (7).

4.Screening for disease resistance in the following generations:

Seeds of F2 selected plants were artificially inoculated with teliospores of flag smut causal agent. The inoculated seeds of each selected plant were planted in the field and the growth room using the same procedures mentioned above. At growth room conditions, a fast, accurate and simple method for evaluating the host reactions against *U.agropyri* was undertaken (5). For yellow rust, the seeds of the same genotypes were planted in the second week of December and they were inoculated with water suspension of urediospores of *P. striiformis* at heading stage. These tests either for flag smut or yellow rust were repeated on the selected hybrids in F4 season. In the end of F4, many hybrid lines were selected. The selected hybrid lines then were thoroughly introduced in a comprehensive study during F5 included the productivity on plot wise ($1m^2$ and $13.5m^2$) along with evaluating their host reactions against bunt, flag smut and yellow rust diseases following artificial inoculations (1,9). Host reactions against smut diseases were recorded based on disease incidence where HR represent the highly resistance (No

Yellow or stripe rust caused by *Puccinia striiformis* Westend, could be the most important wheat diseases. Therefore; the disease gets too much attention because of its wide distribution and the pathogen diversity in its causal agent (11, 17, 20). Although the disease is characteristic of cooler places than the leaf and black stem rusts diseases, it's become a worldwide in temperate latitudes and at high altitudes in the tropics. Thus, the disease reached Australia in 1979 and disease epiphytotics were reported in different environment regions such as China, Australi and Ethiopia (11, 19). In Arab world, yellow rust is annually occurs and caused considerable loss in Syria 1988 (10), Lebanon and Egypt during 1994 and 1995 respectively (14, 15). In Iraq, in contrary to leaf rust, the disease until 1990, considered as a secondary and its often occurrence had been observed in the Northern part of Iraq (2). During the last decade, remarkable shifting in the virulence of the causal agent could be existed. The result of this shifting was reflected in frequent occurrence of epiphytotics, which caused considerable losses (6). The virulence of the pathogen did successfully overcome the resistance genes Yr6, Yr7, Yr9, Yr11, Yr18, YrA, and YrSk in Baghdad area (3). Therefore, disease resistance concept for yellow rust should be considered as a primary factor in any crop improvement program in wheat and in the policy of cultivar introduction or release in Iraq.

The study reported here represented the main part of a breeding program between Mexipak cultivar and the resistance source R-23 aimed to develop a new bread wheat cultivar with disease resistance against yellow rust and flag smut along with high yield potential and agronomic traits.

MATERIALS AND METHODS

1. Searching for disease resistance:

Seeds groups of 23 wheat genotypes were artificially inoculated with three groups of *U. agropyri* teliospores collected from Suwaira, Rabeaa, and Rashidyia regions. The inoculum was prepared by grinding infected wheat leaves (2gm per 100gm.of seeds), which represent 0.5 gm spores/100gm. seeds. The inoculated seeds were planted in moist filed plot (Irrigated three days prior to sowing) at Tuwaitha Experimental Station. The wheat genotypes included nine cultivars such as Saber beg; Mexipak; Araz; Inia 66; Abu-Ghraib-3; Abu-Ghraib-4; Ajeeba; Iratom; and Nuri 70, four hybrid lines namely Saber begX Mexipak(SM); Saber begXAraz(SA); MexipakXAbu-Ghraib3(MSAB3); MexipakXAbu-Ghraib4(MSAB4), and ten biotypes or variants such as 802; 337; 336; 749;M-17; M-27; M-94; R-23; R-24; and R-250. In order to avoid teliospores leaching from the seeds, the plots received the second irrigation when 75% of the seedlings were emerged. Disease incidence was taken at the 5th growing phase which represent heading stage (22). However, all the plants were artificially inoculated many times with water suspension of *P.striiformis* urediospores during the season. The inoculum was prepared by soaking and brushing heavy infected leaves of

Iraqi J. Agric. Vol.11 No.2 pp. 146-156 Nov./2006

DEVELOPMENT OF BREAD WHEAT CULTIVAR "BABIL 113" IN IRAQ

M. A. Al-Hamdany
I. H. Kadhem
H. A. Abass
H. Y. Jaber

ABSTRACT

Long term breeding program aimed to develop bread wheat cultivar having resistant reactions to flag smut and yellow rust diseases was initiated in 1991. Following the designation of R-23 as a source of resistance to both diseases, the source was successfully introduced in a breeding program with wheat cultivar Mexipak using pedigree method. The progenies of three consecutive generations (F3-F5) were screened under artificial inoculations in both growth room and field conditions at Tuwaitha Experimental Station in Baghdad. A very simple and fast screening procedure for flag smut was adapted in growth room conditions to identify the resistant genotypes. At mean time, the plants of selected hybrid lines were screened against both diseases under field conditions using artificial inoculations. Out off 152 hybrid lines, eleven promising lines were selected in the end of F5. The selected hybrid lines were introduced in comprehensive evaluation tests for their disease responses against the causal agents of flag smut, bunt and yellow rust diseases. However, some yield components were also investigated. As a result of all these studies, a new promising hybrid line called Babil 113 was chosen. This line was significantly surpassed Mexipak cultivar in the productivity and disease resistance. The new cultivar also surpassed cultivar Tamoze 2 in the productivity and some agronomic traits. Babil 113 was registered and released by the National Committee of Registration and Release of Agricultural Cultivars/Ministry of Agriculture in 2000 (No.19 on 11/11/2000).

INTRODUCTION

Flag smut on wheat present in the entire world if the sowing seeds were not treated with suitable fungicides (13). The wide variations in disease incidence due to inoculation type, environmental conditions at sowing time, and the wheat genotypes used were thoroughly investigated (8, 21). The above mentioned factors should be considered in any breeding program since they were significantly affected the screening procedures for disease resistance. In Iraq, the disease was registered in 1974 (16), and physiologic specialization in the causal agent *Urocystis agropyri* was reported (1, 12). During this breeding program, a fast and simple screening procedure for flag smut resistance was developed (5). In contrary to other wheat diseases, flag smut does not appear to have a remarkable attention or priority in breeding programmes in spite of the widespread of resistance sources over the world (18, 20).

Ministry of Science and Tech., Agric., Baghdad, Iraq.
Received:July/2005.
Accepted:April/2006.