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تونس

F 1

Bozzini

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PROCEEDINGS

THIRD REGIONAL WHEAT WORKSHOP

- Durum Wheat Improvement
- Weed Control
- Crop Rotation with Annual Forage Legumes
- Seed

Tunis, Tunisia

APRIL 28–MAY 2, 1975

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MAJOR DISEASE PROBLEMS OF DURUM WHEAT AND THEIR DISTRIBUTION WITHIN THE REGION

J.M. Prescott and E.E. Saari

Durum or macaroni wheats (Triticum durum) are grown in many regions of the world but are of significant importance in North Africa, Southern Europe, and the Middle East countries. In the Mediterranean - Middle East region - durum wheats are a favored dietary staple of the people. Accurate data on the production of durum wheat are not readily available as most reports do not separate bread and durum wheat production figures. Whatever the case it is generally understood that there is a ready market for all that is produced. However, at the present time, durum production does not meet the demand. One of the principal reasons is the lack of adapted, high yielding varieties with adequate resistance to the prevalent diseases.

As a class, durum wheats do not differ greatly from bread wheats with respect to the pathogens that can attack them. However, with our present state of awareness, there is a recognizeable distinction in the "forma speciales" or the physiologic races and biotypes of the pathogenic species involved. For example, there are many races or biotypes of stem rust (Puccinia graminis f.sp. tritici) that do not attack durum wheats while causing severe damage to the bread wheats. The other case is also true; that is, some races attack durum but not bread wheat. There is one physiologic race of stem rust, race 189, while capable of attacking both bread and durum wheats, appears to have a preference for durum wheats. Generally, there has been little effort expended on distinguishing between the diseases that affect bread and durum wheats.

In published plant disease surveys there are 36 species of fungi reported to be isolated from and associated with wheat diseases in this region. In addition, there are three bacteria species, five nematode species, and four viruses or mycoplasma organisms associated with wheat. Of these 48 pathogens the three that are presently considered to be of major importance are Septoria leaf blotch (Septoria tritici), stem rust (Puccinia graminis f.sp. tritici), and stripe rust (P. striiformis). In addition to these, there are several that appear to be of moderate importance: powdery mildew (Erysiphe graminis), leaf rust (P. recondita tritici), and scab (Fusarium spp.). The other pathogens, that attack wheat are usually present but on a more limited basis. Some of these pathogens include: the bunts (Tilletia caries, Tilletia foetida and T. controversa), the smuts (*Ustilago nuda*, and *Urocystis tritici*), take-all (*Ophiobolus graminis*), foot rot (*Cercosporella hepotrichoides*), root rots (*Helminthosporium* spp. and *Pythium* spp.), black chaff (*Xanthomonas translucens*), and basal glume rot (*Pseudomonas atrofaciens*).

The magnitude of the disease resistance situation of durum wheats varies with respect to each disease and country or sub-region within this Mediterranean - Middle East area. The six major and moderately important diseases are found in all countries within the region. However, local conditions within each country dictate the diseases (or even races) that limit production. Temperature and moisture are probably the most important environmental considerations. In general, septoria leaf blotch, stem rust, and leaf rust can be important region-wide while powdery mildew and scab are limited to the coastal or high rainfall areas, and stripe rust to the cooler areas of the region.

To illustrate the disease resistance situation of durum wheats within the region, eleven varieties commonly grown or used in breeding programs and their reaction to stem rust are presented in Table 1. In Egypt, the varieties Wells, Leeds, and Hercules provided excellent protection to the 1971-72 virulence spectrum. However, in Turkey, for the same period, the resistance of these three varieties was not effective. The main point is not that there are obvious differences in the pathogen population but that within this population there are entities that can overcome the resistance genes of these varieties. In the same context, the advanced lines presented in Table 2 and their range of reaction to stem rust convey a similar idea.

To further illustrate the endemic virulence and resistance trends a comparison of the average coefficient of infection for the three rusts among local (checks), improved and dwarf durum varieties for the three year period 1972-74 is presented in Tables 3, 4, and 5. An average coefficient of infection greater than 10 suggests that the varieties in this class have less than adequate resistance, and should be replaced. A value between 5.0 and 10.0 suggests reasonable levels of resistance, however, new sources of resistance may be needed shortly. A value less than 5.0 suggests the presence of adequate resistance. Based on the data assembled from the Regional Trap Nursery (RTN) over a three year period it can be said that the local or check varieties do not have adequate resistance for the three rusts and that they could sustain heavy damage whenever the conditions for an epidemic are suitable. The improved varieties, as a class, vary according to the rust but generally speaking their resistance levels are barely adequate and new sources of resistance are needed. The dwarf varieties appear to have adequate resistance to stripe rust but only reasonable levels of resistance to stem and leaf rust.

When the durum classes are compared to the bread wheat classes (Table 3, 4, and 5) it appears that the bread wheats have more effective protection from stem and stripe rust and approximately the same levels of protection from leaf rust. This might be somewhat expected by virtue of the intensive effort to improve the bread wheats in the past.

the smuts (*Ustilago nuda*, and *Urocystis tritici*), take-all (*Ophiobolus graminis*), foot rot (*Cercosporella hepotrichoides*), root rots (*Helminthosporium* spp. and *Pythium* spp.), black chaff (*Xanthomonas translucens*), and basal glume rot (*Pseudomonas atrofaciens*).

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When the durum classes are compared to the bread wheat classes (Table 3, 4, and 5) it appears that the bread wheats have more effective protection from stem and stripe rust and approximately the same levels of protection from leaf rust. This might be somewhat expected by virtue of the intensive effort to improve the bread wheats in the past.

A nursery for screening both spring and winter durums has been established in the region. Tables 6 and 7 summarize the observations on winter durums for resistance to the major diseases and the level of winterhardiness. Tables 8 and 9 summarize observations of disease resistance in the RDISN (Regional Disease and Insect Screening Nursery) for the spring habit durums.

In summary, there are a number of pathogens attacking wheat but little distinction of those attacking durum or bread wheats has been made. Whatever the case, there are a number of pathogens that limit the production of durum wheats within the Mediterranean - Middle East region. There is a real need to widen the genetic base of the durum wheats, particularly with respect to disease resistance. Increased efforts are needed to identify, test, and release adapted, high yielding durum varieties for this region.

DISCUSSION

Question: In tables 3, 4 and 5 what does "all durums" or "all wheats" include?

Answer: "All durums" or "All bread wheats (BW)" include "checks" which are local varieties plus the improved category and the dwarf category. The "improved" category includes varieties which have been developed to replace local types (example Capeiti). The "dwarf" category includes representatives from the Norin 10/ Brevor dwarfs (example Cocorit 71).

Question: How many locations are involved in RTN?

Answer: In 1973-74 150 Regional Trap Nurseries were sent out to 32 different countries. The Durum varieties included 4 local checks, 8 improved and 2 dwarf, making a total of 14.

Question: Is there any relationship between the stage of growth of certain varieties and resistance? In other words, could we consider a variety resistant in certain stages of growth to a particular race or biotype of stem or leaf rust, and susceptible when reaching later stages; or the opposite, heavily attacked when in the seedling stage but resistant later on?

Answer: Yes, there is a very good correlation between stage of growth and resistance. You find all categories but most fall in the groups of susceptible or resistant as a seedling and the same response as an adult. However, some are resistant as a seedling and susceptible as an adult and vice versa.

Question: Do you think that there is any kind of seasonality or cycling regarding the incidence of certain diseases such as stem rust or leaf rust? For example, did any of them become severe or epidemic once every 3 or 4 years?

Answer: As to seasonality, about the only influence is due to environmental conditions that influence rust carryover from year to year. Cyclic patterns are dependent upon the environment plus the traits of the pathogen population and the survival of inoculum. With the present status of knowledge we are not yet in a position to predict epidemic frequency.

Table 1. Reaction of Eleven Varieties of *Triticum durum*, to *Puccinia graminis tritici* in Egypt and Turkey, in 1971-72.

Variety	Egypt	Turkey		
		Ankara	İzmir	Diyarbakir
Wells	5MR	60S	20S	10MS
Leeds	5R	30S	30S	40S
Tehuacan	70S	100S	50S	20MR
Cocorit 71	60S	20MS	40S	30S
Hercules	10MR	80S	30S	60S
Chapala 67	40S	10S	60S	10R
Oviachic	40S	100S	50S	80S
Jori C-69	80S	80S	30S	TMR
Barrigon Yaqui$_E$	-	20S	30S	10R
Langdon	-	60S	30S	20MR
Stewart 63	-	40MS	20S	20MS

Table 2. Range of rust reactions of various selections of *Triticum durum* in Turkey in 1971-72.

Variety/line	N. of lines tested	Pgt (Stem rust)	Prt (Leaf Rust)	Ps (Stripe Rust)
Anhinga 'S'	4	10S-50S	5S-60S	30S-50S
Crane 'S'	5	30S-80S	20S-30S	10S-60S
Ganso 'S'	4	80S	30S-40S	30S-50S
Garza 'S'	4	20S-70S	10S-60S	20S-80S
Pelicano 'S'	3	70S	40S-70S	20S-30S
Flamingo 'S'	7	70S-90S	TR-50S	30S-80S
Pinguino 'S'	8	20S-80S	10S-30S	40S-70S
Booby 'S'	9	30S-50S	20S-40S	20S-30S
Brant 'S'	3	5S-10S	50S-70S	5S-10S

Table 3. Comparison of the average coefficient of infection1/ of several variety groupings within the Regional Trap Nursery for stem rust for a three year period.

	1971-72	1972-73	1973-74
Durum checks	33.08	18.65	14.60
All Durums	25.03	14.13	11.24
Imp. Durums	14.29	16.66	10.98
Dwf. Durums	-	7.09	5.15
BW checks	43.32	34.34	23.28
All BW	14.74	18.30	6.95
Imp. BW	16.19	14.32	9.92
Dwf. BW	6.69	6.24	2.62
All checks	36.49	26.50	18.94
All Entries	19.89	16.22	8.07

Table 4. Comparison of the average coefficient of infection1/ of several variety groupings within the Regional Trap Nursery for leaf rust for a three year period.

	1971-72	1972-73	1973-74
All Durums	25.58	16.19	11.98
Durums Checks	37.61	20.26	18.05
Imp. Durums	9.54	18.60	8.96
Dwf. Durums	-	9.72	7.40
All BW	22.25	26.80	12.78
BW Checks	50.18	43.59	36.43
Imp. BW	23.59	20.68	16.32
Dwf. BW	11.53	16.15	7.62
All Checks	43.90	31.93	27.24
All Entries	23.92	21.50	12.58

Table 5. Comparison of the average coefficient of infection1/ of several variety groups within the Regional Trap Nursery for stripe rust for a three year period.

	1971-72	1972-73	1973-74
All Durums	14.51	12.54	10.26
Durums Checks	15.94	20.65	17.65
Imp. Durums	12.57	10.86	7.72
Dwf. Durums	-	6.11	1.85
All BW	9.34	9.91	4.56
BW Checks	26.73	13.20	12.92
Imp. BW	8.49	8.43	4.37
Dwf. BW	7.21	8.10	4.85
All Checks	21.34	16.93	15.29
All Entries	11.93	11.23	6.03

1/ 0-5 = good resistance, 5-10 = reasonable resistance, above 10 = inadequate resistance.

Table 6. Sources of resistance to the rusts from 1st IWDSN (International Winter Durum Screening Nursery) with acceptable 1/ levels of winterhardiness.

Stripe rust:	
Capraz bugday 1018 - Leeds	C9-63
073/44 - Introd. 2498	D011-1A-10A-0A

1/ Acceptable equals the winterhardiness of Bezostaya.

Table 7. Sources of resistance to the rusts from 1st IWDSN with little or no winterhardiness.

Stem & Stripe rust:	
G11"S"(BR180-Lak/Gz-60-220x61-130	D26842-21Y-3M-0Y
Crane "S"	D23055-56M-5Y-2M-0Y
LD 357$_E$-Tc^{2}xJo"S"	D27534-1M-1Y-1M-0Y
D6647	-
61-130-Leeds	D6659
Capraz bug-Leeds	C11-25
Cocorit "S"	D27617-18M-6Y-1M-0Y
61-130-Kunduru 414/44	D27617-1A-23A-0A
LD357$_E$-Tc^2 x Jo"S"	D27534-3M-1Y-4M-1Y-0M
21563-Gs "S"	27584-5M-1Y-3M-0Y
21563-Jo "S"	31538-14M-6Y-0M
Crane "S"	23055-56M-6Y-2M-0Y
LD357$_E$-Tc^2 x Jo "S"	27534-1M-1Y-1M-0D
D.Dwf.-S15xCr "S"	33312-9Y-2M-0Y

Ste n & Stripe rust: (Cont'd.)

D.Dwf.-S15xCr "S"	33312-9Y-9M-0Y
Jo "S"-Cr "S"	27591-3M-3Y-0M
Cfn-Lan^2_E	A3433-201p-3p-20p-1p-0D
P67/1114	12:61 (GT).27-2T-0T-1T-0T
STW63/TM_E-Tc^2 x ZBW	23626-9A-4A-8A-0A

Stem rust:

ESK 8178	-
61-130-Leeds x Capraz bug 1018	C29-13
LD 308	-
61-130-Leeds	D6654
Bo "S"	21263-54-1Y-2Y-4M-2Y-100M-0S
Bo "S"	21263-54-1Y-2Y-5M-1Y-100M-0S
S/N-Ag.elong.xTAC125/ZBW	22299-5M-3R-1M-1R-2C-0R
AA "S"(CP^3_E-Gz x Tc^3/ BY^2_E-Tc)	31733-4M-6Y-2M-0Y
Masa -11Y-1M-0Y	-

Stripe rust:

Flamingo "S"	D27582-5M-3Y-1M-500Y-0D
Cr "S"/T.pol^2_E-Tc^2 x G11"S"	D31725-3M-8Y-0M
Cisne "S"	D27617-18M-6Y-0M
Crane "S"	D26055-56M-5Y-3M-0Y
BY^2_E-TAC_ExAA "S"	D27625-5M-2Y-2M-0Y
Kobak 2916-61-130	C21-6-0A
61-130-AKb253-39	C24-36-0A

Stripe rust: (Cont'd.)

Cocorit "S"	D27617-18M-6Y-2M-0Y
Üveyik 126-61-130	C23-9-0A
Berkman	-
B144	-
Masa-165y-0M	-
D.Dwf.-S15xJo "S"	33303-3Y-1M-0Y
D.Dwf.-S15xCr "S"	33312-9Y-5M-0Y
Gerardo Vz 469	-
Anhinga "S"	22234-18M-8R-0M
Ganzo "S"	22550-10M-5Y-1M-2Y-1M-0Y
CP-St 464	Ch 3268-3p-3p-0D
6684-6645	-
Cr "S"-Gs "S"	28980-28Y-13M-500Y-501M-0Y
61-130-Üveyik	1A-59A-0A
073/44	D011-1A-5A-0A
61-130-Lds x Gokala 24	C28-9-1

Table 8. Sources of resistance in durum wheats based on data from the RDISN.

Stem rust	Leaf rust	Stripe rust
Flamingo	NP 401	Moh'd. Ben Bachir
Durum variety 24	NP 404	Maliani 11 C
Valgerardo	NP 412	Quilafen
Egypt Local No. 8	P.I. 153774	Berkman
Tai	P.I. 297839	Flamingo
Kasuku	CI. 13160	Oviachic
CI. 8155	Moh'd. Ben Bachir	Chapala 65
D-16	Maghrebi 72	Castel del Monte
Stewart 63	Pelicano	Crane
Leeds	Kyperunda	Tehuacan 60
Hercules	Durum Variety 24	Capeiti
Jori C-69	Chapala	Senator Capelli
Langdon	Leeds	Sincape
Wells	Maliani 11 C	Maliani 8 D
Yuma	Valnova	Jucci
Anhinga	Saba	Raneiri
Maliani 11 C	Duro de Cardeite	Zenati Bouteille
Valnova		Chile-931
		Grec-46049

Table 9. Durum Wheat Varieties included in the 2nd RDISN 1971-72 with good resistance to Septoria tritici in the Near East and North Africa1/

RDISN No.	Variety or Cross	Aver. Score2/	High Score	Pd. Mild React.3/
894	Jaafari	3.3	6	MS
1027	Lobeiro	3.5	5	S
1028	Preto Amarelo	3.5	5	S
1452	Leeds	3.5	7	MR
2330	Mouri	3.5	5	MR
1410	Golden Ball	3.8	6	S
1454	Wells	3.8	8	S
1029	Amarelejo	4.0	5	S
1455	Langdon	4.0	7	MS

1/ Based on data collected from Algeria, Ethiopia, Lebanon, Tunisia and Turkey.

2/ Based on disease score using the 0-9 scale.

3/ Powdery Mildew observations from Poland and France.

PROBLEMES MAJEURS CONCERNANT LES MALADIES DU BLE DUR ET LEUR REPARTITION DANS LA REGION

E.E. Saari et J.M. Prescott

RESUME:

Le contrôle des maladies du blé est considéré comme le facteur principal de la stabilisation de la production du blé. Ceci est particulièrement vrai en Asie et en Afrique du Nord où le blé est cultivé depuis des siècles; dans ces régions, on peut trouver un certain nombre de références sur les maladies folières et les oïdeums qui affectent le blé. En général, peu d'efforts ont été faits pour distinguer les maladies qui affectent le *Triticum aestivum*, et le *T. durum*.

Dans les enquêtes publiées sur les maladies des plantes, 36 espèces de fungi ayant un lien avec les maladies du blé de cette région, ont été identifiées. En outre, il y a 3 espèces bactériennes, 5 espèces de nématodes et 4 virus ou mycoplasmes associés au blé. Il y a d'autre part, 15 espèces de fungi qui peuvent endommager les graines en stockage. Fort heureusement, la plupart des espèces de pathogènes signalées sont relativement peu importantes.

Peu de travaux ont été faits pour déterminer à quelle fréquence les maladies se développent et les limites de leur répartition. Ceci est vrai pour la plupart des régions du monde où l'on cultive le blé. On a tendance à n'enregistrer que les maladies qui provoquent des épidémies ou des pandémies. En conséquence, nos données sur les maladies chroniques du blé sont pratiquement nulles. Les meilleures estimations des pertes dues aux maladies du blé en Afrique du Nord indiquent une perte annuelle minimum de 12%. Ce pourcentage ne fait pas de distinction entre les blés tendres et les blés durs.

D'après ce que nous connaissons à l'heure actuelle du problème, les maladies importantes du blé dur sont les mêmes que celles du blé tendre. Il y a une différence visible dans les *forma speciales* ou les races physiologiques des espèces pathogènes concernées. La classification de ces espèces en sous-classes peut souvent être effectuée seulement en laboratoire ou dans une serre.

Dans les efforts de développement d'une variété de blé dur à haut rendement pour l'Afrique du Nord, il faudrait essayer d'identifier une variété résistante en priorité à la Septoria tritici et ensuite à la Puccinia graminis. Plusieurs autres maladies existent et on ne peut pas les négliger si on veut améliorer le niveau technologique de la culture pour accroître la production du blé dur. Les maladies qui requièreront probablement toute notre attention à l'avenir sont: l'Helminthosporium, le oïdum et la pourriture des racines.

Original: Anglais

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