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BLACK STEM RUST DISEASE OF WHEAT IN THE SUDAN - A PRELIMINARY REPORT

BY

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The history of wheat production in the Sudan has been reviewed by Khalifa et al (1974). Wheat is one of the main food crops in the Sudan and plays an important role in the economy of the country. The total area under wheat in this country has steadily risen to 750,000 feddans (feddan = 1.038 acres) in 1975/76 (Anderson and Srivastava, 1976). The area cultivated with wheat in the Sudan at present is large enough to meet the local consumption and also to provide substantial quantities for export.

However, one of the problems which threaten wheat production in the Northern Province, Khahsm EL Girba district and Jebel Marra area is black stem rust of wheat Puccinia graminis f.sp. tritici Erikss. and Henn.

So far, stem rust is believed to be the only type of wheat rust present in the Sudan (Boughey, 1948, Tarr, 1955 and Khalifa, 1964/65). Early incidence of this disease was reported in 1924, 1941 and 1943 from the "Northern Province", followed by other records in 1943 and 1944 from the "Gezira Province" (Boughey, 1942 and Tarr, 1955). Later, it was found in Jebel Marra "Dafur Province" (Tothill, 1948). Recently it was reported

in Khashm El Girba district "Kassala Province" (Khalifa, 1964/65).

In Northern Province black stem rust is widespread on wheat and causes considerable crop losses in warm, humid seasons and reduces grain yield by 50% or more (Tarr, 1953/54). The disease is also very serious in Khashm EL Girba district and will remain worthy of consideration when introducing new varieties (Khalifa, 64/65).

The usual time for disease appearance in the Northern Province and in Khashm EL Girba district is between mid January and mid February. However, in Jebel Marra the disease appears during the winter and autumn, but seems to be very severe during the autumn (Tothill, 1948).

The source of primary infection by the stem rust fungus Jebel Marra and Khashm EL Girba is not known with certainty. In the Nothern Province of the seasonal carry-over of Puccinia graminis is not understood since neither aecidia nor the barberry occur and the uredospores are thought to be relatively short-lived; it is possible that wheat in Northern Province is infected annually by uredospores carried by wind from Egypt but there is no certain evidence for this (Tarr, 1955).

CONCLUSION

The writer believes that, black stem rust of wheat is very important and needs special consideration, as with expansion of wheat growing areas, the disease may create a major problem. Especially in Khashm EL Girba the disease is prevalent and very serious and can threaten the cultivation of wheat. However, at present the disease is under control due to the use of resistant

Especially in Khashm EL Girba the disease is prevalent and very serious and can threaten the cultivation of wheat. However, at present the disease is under control due to the use of resistant varieties such as Giza 155 and Mexicani.

It is possible that, with the passage of time these varieties may become liable to attack by the stem rust pathogen, due to the advent of new physiologic races. This is because the fungus is a complex consisting of about 325 physiologic races and biotypes (Stakman et al, 1962 and Stewart, 1970). There are instances in which certain wheat varieties have been produced and were known to be resistant to the stem rust races present in that locality, but in a short time they become susceptible due to the occurrence of new physiologic races (Abdel-Hak. et al, (1966).

It has been stated above, the source of primary infection in Kashm EL Girba and Jebel Marra is not known, and it may come from neighbouring countries. Epidemiological studies conducted in European countries have proved that stem rust epidemics occurring in those countries are caused by outside stem rust spores carried by wind between neighbouring counties or from countries far away (Ogilvie and Thorpe,1961 and Santiago, 1956).

In the light of these facts, it is very desirable to investigate the following:

(a) Survey the geographical distribution and identification of the physiologic races of stem rust in the country.

(b) Screening the wheat varieties (local, imported and the selections from cross material locally prepared) against the identified races.

(c) Study the epidemiology of the disease in the country.

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EFFECT OF SINK REMOVAL ON PARTIAL RESISTANCE OF FOUR BARLEY CULTIVARS TO PUCCINIA HORDEI

BY

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SUMMARY

The ears of four spring barley cultivars, representing the known range of partial resistance, were removed at heading just before innoculation with the Puccinia hordei race 1-2-1.

Removal of the ears increased the expression of partial resistance, measured as a longer latent period and a reduced infection frequency. The higher the partial resistance of the cultivar the more pronounced this increase was.

INTRODUCTION

Partial resistance of barley to brown rust, caused by Puccinia hordei Otth., is characterized by a reduced rate of epidemic development, despite a susceptible infection type (Parlevliet, 1975). The major components of partial resistance are latent period (LP), infection frequency (IF) and spore production (SP) per urediosorus per unit of time (Parlevliet, 1979). In the barley-brown rust relationship the components are

associated with one another; longer LPs, reduced IFs and lower rates of SP tend to go together (Neervoort and Parlevliet, 1978). Partial resistance in the field is strongly correlated with these components (Neervoort and Parlevliet 1978; Parlevliet and Kuiper, 1977). Because of the strong association between the components partial resistance can be evaluated very well by the LP alone, the correlation co-efficient between partial resistance and LP being about 0.9 (Parlevliet and Van Ommeren, 1975; Neervoort and Parlevliet, (1978).

The LP of a cultivar varies with the development of the plant and the age of the leaves. As soon as leaves show symptoms of ageing the LP becomes shorter (Parlevliet, 1975). Removing the ear appears to retard this senescence process; the leaves remain green for a considerably longer period. To see whether the removal of the ears had an effect on partial resistance an experiment was carried out. To this end four cultivars, representing the range of partial resistance found in Western Europe, were taken (Parlevliet and Van Ommeren, 1975). The IF relative to the most susceptible cultivar and the LP of the cultivars L94, Sultan, Julia and Vada, as measured over various experiments, were 100, 70, 65 and 50% and 8, 10.5 , 13 and 15 days respectively (Parlevliet and Kuiper, 1977; Neervoort and Parlevliet, 1978; Parlevliet, 1978).

MATERIALS AND METHODS

The spring barley cultivars L94, Sultan, Julia and Vada were sown weekly in black plastic pot of 12 x 12 cm. Six pots were sown, per cultivar per sowing date, two seeds per pot and after

emergence thinned to one plant per pot. When the ears emerged they were removed from three plants, taken randomly from each series of six plants. Afterwards they were inoculated with urediospores of race 1-2-1 as described by Parlevliet, (1975). The LP was measured on up to four flagleaves following Parlevliet (1975). The IF was determined on the same flagleaves by counting the number of urediosori on each leaf and by measuring the area of these flagleaves. Sultan, Julia and Vada, having about the same earliness were always inoculated simultaneously. L94, being much earlier, was, in several series, inoculated on other days but at the same period and the same growth stage. Of the former three cultivars, 11 series, and of L94, 13 series were evaluated.

Within each series the tillers were used as the units. The LP and IF per treatment per series therefore was calculated as an average over the tillers. Since the numbers of evaluated tillers per plant was not always four, plants did not contribute equally to the series means. The series means in turn were averaged again to obtain the overall treatment means, which are shown in Table 1. Analysis of variance was carried out on these series means.

RESULTS AND DISCUSSION

The LP and IF measured in this experiment (Table 1) conform very well with those averaged over former experiments (see introduction). Removing the ears just before inoculaton did enhance the expression of partial resistance. L94 without any partial resistance showed no effect of the treatment. With an

increase of the partial resistance, measured here as an increased LP and a decreased IF, the effect of ear removal increased being just not significant with Sultan (for LP) and most pronounced with Vada.

The removal of the sinc may exert its effect on either of two ways:

(i) The senescence of the flag leaves is retarded and the partial resistance of the flag leaves consequently does not decrease as fast as that in flag leaves with the unretarded progression of senescence. Other authors too reported that the resistance of ageing leaves diminished (Mence and Pegg, 1971; Ulrich, 1976). This assumes a direct relationship between senescence and partial resistance of the leaf.

(ii) Resistance to biotrophic pathogens like brown rust is probably an active process requiring energy (Smedegaard-Peterson and Stolen, 1981). If this is so, partial resistance and the ear compete for the same source. Absence of the sinc would mean that more energy is available for the expression of partial resistance resulting in a better expression of it. In Coffee too it has been observed that the resistance to Coffee leaf rust of a tree increases markedly when the yield of the tree decreases (Monaco, 1977; Eskes and Carvalho, 1983).

It is also possible that both processes, the senescence of the leaves accompanying the seed formation, and the competition for the same sources influence the partial resistace. It is not possible to distinguish between these possible causes.

TABLE 1 - Latent period (LP) in days and infection frequency (IF) in urediosori per cm2 of four spring barley cultivars inoculated with Puccinia hordei, race 1-2-1. Half of the plants had the ears removed when just heading and before innoculation.

Cultivar	Treatment	LP	IF	Relative IF (%)
L94	ear	9.3	62.1)	100
	no ear	9.3	65.9)	
Sultan	ear	12.5	46.1)	82
	no ear	13.6	58.7)	
Julia	ear	14.6*	48.8)	73
	no ear	16.4	45.0)	
Vada	ear	16.8*	38.9*)	47
	no ear	18.5	21.1)	

* Difference between ear and no ear significant at P = 0.01.

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ON THE TAXONOMY AND ECOLOGY OF PUCCINIA GRAMINIS

BY

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There are some previous papers dealing with infra-specific taxonomy and, recently, also ecology of the stem rust of grasses, Puccinia graminis Pers. s.l. (Urban,1980; Savile and Urban, 1982). Previously Urban (1967) suggested the stem rust fungus was a complex of two subspecies: Puccinia graminis subsp. graminis, and P. graminis subsp. graminicola Urban; the former unit embraces two varieties as var. tritici - the common wheat stem rust, and var. stakmanii (Guyot, Massenot et Saccas) ex Urban - the stem rust of rye, barley and oats. This taxonomic concept was elaborated first of all on European data relating to morphology and physiology of the fungus and was accepted by Cummins (1971), and gradually also by other authors [Azbukina (1971),Boerema and Verhoeven (1972), Cagas (1975), Henderson and Bennell (1979), Ullrich (1977)]. The study of additional material originating especially from primary and secondary evolutionary gen centres of cereals, the stem rust fungus and species of Berberis such as: Transcausasia, Azerbajdhan SSR, Iran, Iraq, Turkey and Israel, presents new and enlarging view on the taxonomy (and evolution) of Puccinia graminis s.l. Also encouraging were experiments and statistical elaboration of the material from localities rich in barberry in the West and

East of Slovakia. Valuable information and data from Morocco, Algeria and The Pyrenean peninsula were found in papers by A. L. Guyot, M. Massenot, A. Saccas and G. Malencon.

In primary and secondary (the Mediterranean) evolutionary centres there are very common stem rust populations, the urediniospores of which are relatively big, either "oblong-ellipsoid" or "ovoid". The suggested urediniospore shape characteristics are based on the correlation of the arthimetic mean of length $\bar{x}$ and the ratio $\bar{x}$ of the length $\bar{x}$ to of the width.

There are additional urediniospore shape characteristics completely presented below:

Urediniospore $\bar{x}_L > 26$ µm; $\bar{x}_L : \bar{x}_W > 1,7$ - oblong-ellipsoid

$\bar{x}_L > 27$ µm; $\bar{x}_L : \bar{x}_W < 1,7$ - ovoid

] sub. graminis

Urediniospore $\bar{x}_L < 27$ µm; $\bar{x}_L : \bar{x}_W < 1,6$ - small ovoid

$\bar{x}_L < 26$ µm; $\bar{x}_L : \bar{x}_W > 1,6$ - small oblong

] subsp. graminicola

In the countries mentioned above big urediniospores are found either on hexaploid cultivated wheats and other cereals or on wild growing grass genera such as Hordeum, Aegilops, Avena, Agropyron, Eremopyrum, Dasypyrum, Bromus, Festuca (Poa, Elymus, Alopecurus, Lolium). This big urediniospore population belongs to the subspecies graminis which embraces in the evolutionary centres both cerealicolous and graminicolous physiologic races

(specialised forms?). The reason for this is the hybridizing of rust in plant formations and plant communities in which various grasses and cereals naturally grow together with the alternate host of the stem rust, Berberis sp. div.

In the same countries, however, we find stem rust populations the urediniospores of which are characterized as "small ovoid". They were studied on Dactylis glomerata, Poa angustifolia, Poa pratensis, Poa sp., Lolium perenne, Lolium persicum, Cynosurus echinatus and rarely, also on Bromus sp., Avena sterilis, Hordeum bulbosum, Hordeum murinum, Festuca granatensis. They belong to the subspecies graminicola and we suppose that these populations, together with some others having big ovoid urediniospores are closest to the original, ancestral form of the stem rust fungus.

The material recently studied in the natural preserve Sulovske skaly (near Zilina, W. Slovakia) and in the neighbourhood of Presov in E. Slovakia, where barberry bushes are numerous, shows the presence of physiologic races (specialised forms) belonging to both subspecies of Puccinia graminis. Big uredinispores being oblong-ellipsoid to ovoid characterise in Sulov f. sp. Agropyron repens - Dactylis glomerata and near Presov f. sp. Agropyron repens (- Secale cereale).

They represent the sub-species graminis and alernate hosts every year on the locality. On the other hand in both localities there persist simultaneously additional specialised forms with small urediniospores: f.sp. Festuca pratensis - Agrostis tenuis in Sulov and f.sp. Agrostis - Poa near Presov. Their summer spores are characterised as small ovoid to small oblong and belong to the subspecies graminicola. Obviously hybridisation

between both subspecies takes place because graminicolous specialised forms just mentioned are in the closest relation with aecia on the barberries.

Results presented in this preliminary note support the theory of the origin and evolution of Puccinia graminis s.l. and, together with previous data of the authors (Guyot et al, 1946) give additional, new basis for understanding the taxonomic variability of graminicolous physiologic races (specialised forms?).

The discovery of physiologic races (specialised forms?) in Czechoslovakia which belong to subspecies graminis and seem to be not identical with any previous known cerealicolous race requests futher intensive study on the broad international basis. This would be with regard to the possibility of survival of some dangerous cerealicolous races on Agropyron repens or on other wild grasses not only in Czechoslovakia but especially in countries lying to the south and south east. Only until it is completed it will be possible to sketch efficient recommendation for integrated stem rust control strategy.

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SOURCES OF RESISTANCE TO RUSTS AND POWDERY MILDEW IN WHEAT

BY

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The authors had evaluated about 2400 entries of exotic durums in earlier communications (Bahadur et.al., 1977 and 1979). About 500 entries developed at Breeding Centres of Central Zone, under the All Inida Wheat Improvement Programme were further evaluated during 1976-1979. The results of the promising entries screened for resistance to rusts and powdery mildew are presented here.

MATERIAL AND METHODS

The entries were sown at 4 different hot-spots, Dholakuan, Indore, Mahabaleshwar and Wellington. The first location is in the Northern, the middle two in the Central and last one in the Southern part of India. Entries were sown in 1m rows under medium fertility. At Indore and Mahabaleswar the inoculum of all the races of stem and leaf rusts was also sprayed in addition to natural infection of rusts and other diseases. The

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rust reactions were recorded at late dough stage. At Dholakuan and Wellington, natural infection of stripe rust and powdery mildew of wheat was also recorded. The resistant entries identified during 1977 were further tested for two more years. All the promising entries were screened with individual races of stem and leaf rusts at the seedling stage at Simla, according to standard procedure (Joshi, Prasada and Goel, 1965).

Modified Cobbs scale was used to record rust observations and average coefficients calculated as proposed by McNeal et.al. (1971).

Entries were classified into various categories according to average coefficient index (ACI). The powdery mildew was scored on a 0-9 scale. The pedigree of these entries are given in Table 1.

RESULTS AND DISCUSSION

Thirty one entries are classified into the following groups and their ACI and highest disease score (HS) are mentioned in Table 2.

RESISTANT (ACI 0.1 to 5).

Stem and leaf rusts: HB 383, HD 85, HD 94, HI 697, HI 732, HI 761 HI 763, HI 768, HI 788, HI 803, HI 839, HI 840, K 7643, Raj 1575 Raj 1595, Raj 1608, Raj 1633, Raj 1654, Raj 1663, Raj 1665, Raj 1675, Raj 1679.

Stem rust: Raj 1582

Leaf rust: B 86, B 106, HD 96, HD 2257, HI 693, HI 784, P 94, MP 311.

MODERATELY RESISTANT (ACI 5.1 - 10):

Stem rust: B 86, B 108, HD 96, HD 2257, HI 693, HI 784, MP 311, P 94.

Leaf rust: Raj 1582

The reactions of various entries to stem rust races are shown in Table 3. About 20 entries ie. B 86, B 108, HB 383, HD 85, HD 94, HD 96, HD 2257, HI 693, HI 732, HI 761, HI 768, HI 784, HI 839, MP 311, Raj 1575, Raj 1582, Raj 1663, Raj 1665, Raj 1675 AND Raj 1679 are resistant to all the races. All these also show adult plant resistance (ACI 0.1-5) except B 86, B 108, HD 96, HD 2257, HI 693, HI 784 and MP 311, which exhibit moderate resistance (ACI 5.1-10). Other entries, although susceptible to a few races (Table 3) also exhibited adult plant resistance.

The behaviour of leaf rust races to these entries is presented in Table 4. B 108 shows resistance to all the races at the seedling stage and also has adult plant resistance (ACI 0-5). Other entries are susceptible to a few races or exhibit mesothetic reaction but all have adult plant resistance (ACI 0-5) except Raj 1582 which exhibit moderate resistance (ACI 5.1-10).

The studies reveal that Hb 383, HD 85, HD 94, HI 687, HI 732, HI 761, HI 763, HI 768, HI 788, HI 803, HI 839, HI 840, K

7643, Raj 1575, Raj 1595, Raj 1608, Raj 1633, Raj 1654, Raj 1663 Raj 1665, Raj 1675 and Raj 1679 have field resistance to both stem and leaf rusts and classified into first resistant group (ACI 0.1-5). In Central and Penninsular zones of India stripe rust of wheat rarely occurs and HD 2257, HI 687, HI 693, HI 732 and Raj 1608 did not show infection of stripe rust at all the hot spots. Some of these entries - HI 687 (6), HI 693 (5), HI 732 (4), HI 763 (4), HI 784 (7), Raj 1575 (7), Raj 1595 (5), Raj 1608 (6), Raj 1663 (7), Raj 1675 (5) and Raj 1679 (4) also exhibit susceptibility to powdery mildew.

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Table 1: Identity of resistant entries tested at hot spots.

Number	Entries	Pedigree
1	B-86	-
2	B-108	-
3	HB-383	(Cno 'S'-S64 x K1. Rend x 7 cerros)
4	HD-85	-
5	94	-
6	96	-
7	2257	-
8	HI-687	Cno-Bb-Ca1(7c/Lib 64-Inia x Inia-Bb)
9	693	(HI-384 x EA 222-1)
10	732	Tab 8156 x CC-Inia
11	761	(Hyb-65 x HD 1220) x HD 1949)
12	763	(J-17 x H341) (Cno 'S' x Son 64) K1. Rer x 8156)
13	768	Bb-Cno-Ign
14	784	Napo-Tab x 8156/Kalyan-Bb
15	788	Cno-Gallo-Kal-Bb
16	803	-
17	839	Tan-Tob-Cno'S'
18	840	Tab-Tab-Cno'S'
19	K-7643	Cno 'S'-Gallo x Ca1-Bb
20	MP-311	Bb-7c2
21	P-94	-
22	Raj-1575	CPAN 722-HD 2204
23	1582	SKA (Son 64-K1-Rand/Cno/LR 64-564)
24	1595	Bb-Rn/Wren
25	1608	Bb-Tob/Cno-Nor66/C.273/NP 875// E853-3-8
26	1633	Kal Bb//Fanio
27	1654	Bui-Gallo//Eon
28	1663	Cjn x Kal-Bb
29	1665	VCM x Cno'S-7c//Kal.Bb
30	1675	CC x Lr. Sr 70
31	1679	CC x Ca1-Sr.

- not available.

Table 2

Entries	Coefficient index							ACI				Powdery mildew
	Indore		Mahabaleswar		Wellington		Dholakuan	SR		LR		
	SR	LR	SR	LR	SR	LR	LR	ACI	HS	ACI	HS	
B-86	10.0	0.6	12.0	4.0	2.0	10.0	0.0	8.0	40MR	3.6	30MR	-
B-108	13.3	3.3	8.0	4.0	0.0	2.0	0.0	7.1	40MR	2.3	20MR	-
HB-383	3.4	0.6	7.3	3.7	2.0	6.0	2.0	4.2	20MR	3.0	20MR	-
HD-85	5.4	0.0	6.0	2.7	1.0	6.0	0.0	4.1	30MR	2.1	20MR	-
HD-94	2.6	0.0	8.0	8.0	1.3	6,9	0.0	3.9	40MR	3.7	20MR	-
HD-96	6.0	0.0	8.0	2.7	4.0	8.0	0.0	6.0	40MR	2.6	30MR	-
HD-2257	8.0	0.0	6.6	3.4	1.4	2.6	0.0	5.3	40MR	1.5	20MR	-
HI-687	0.0	1.3	4.0	3.0	0.6	9.1	1.0	1.5	20MR	3.6	20MR	6
HI-693	6.6	1.3	9.3	3.3	0.3	9.1	0.0	5.4	40MR	3.4	30MR	5
HI-732	4.0	1.3	5.4	5.0	4.0	1.3	0.0	4.4	20MR	1.9	20MR	4
HI-761	8.0	0.3	6.0	5.0	0.0	0.0	0.0	4.6	40MR	1.3	20MR	-
HI-763	0.0	0.6	5.6	4.6	0.6	6.6	0.0	2.0	30MR	2.9	30MR	4
HI-768	0.0	0.0	4.0	3.3	0.3	2.6	0.0	1.4	20MR	1.4	20MR	-
HI-784	9.3	1.3	10.6	3.4	0.3	6.6	0.0	6.7	40MR	2.8	40MR	7
HI-788	0.6	0.0	5.4	3.4	0.3	2.7	2.0	2.1	20MR	2.0	20MR	-
HI-803	2.6	0.0	4.0	6.0	0.0	4.0	0.0	2.2	20MR	2.5	20MR	-
HI-839	2.6	1.3	5.4	5.3	0.7	2.6	2.0	2.9	20MR	2.8	20MR	-
HI-840	1.3	4.0	5.4	0.0	0.2	4.0	0.0	2.0	20MR	2.0	20MR	-
K-7643	1.3	0.0	5.4	3.4	1.6	2.6	0.0	2.7	20MR	1.5	20MR	-
MP-311	8.0	0.0	10.6	3.4	1.4	2.7	0.0	6.5	30MR	1.5	20MR	-
P-94	3.3	0.0	8.0	5.4	5.6	4.0	0.0	5.6	40MR	3.1	20MR	-
Raj 1575	7.3	0.0	6.0	4.0	0.0	6.0	0.0	4.4	40MR	2.5	30MR	7
Raj 1582	2.6	0.6	8.0	10.0	4.0	10.0	0.0	4.8	30MR	5.1	20MR	-
Raj 1595	6.6	0.0	6.0	4.0	0.1	4.0	0.0	4.2	30MR	2.0	20MR	5
Raj 1608	5.3	0.0	7.0	8.0	0.1	2.0	0.0	4.1	20MR	2.5	20MR	6
Raj 1633	0.1	0.0	4.0	4.0	0.0	8.0	0.0	1.3	20MR	3.0	20MR	-
Raj 1654	0.1	0.0	2.0	2.0	0.0	4.0	0.0	0.7	10MR	1.5	10MR	-
Raj 1663	6.6	0.0	6.0	4.0	2.0	14.0	0.0	4.8	30MR	4.5	40MR	7
Raj 1665	1.3	0.1	4.0	4.0	0.0	4.0	0.0	1.7	20MR	2.0	20MR	-
Raj 1675	0.1	0.0	4.0	4.0	0.1	9.0	0.0	1.4	20MR	3.2	40MR	5
Raj 1679	5.4	0.0	2.0	2.0	0.1	2.0	0.0	2.5	30MR	1.0	10MR	4

SR = stem rust, LR = leaf rust, ACI = average coefficient index and HS = Highest disease score.

TABLE 3: Reactions of various entries to individual races of stem rust of wheat

Entries	Races of stem rust																		
	11A	14	15	17	21	21A-1	24	34	40	40A	42	42B	42B3	117	117A	117A-1	122	184	295
B-86	0;	0;	0;	0;	0;	0;	0;	0;	0;	2	0;	0;	0;	0;	0;	0;	0;	1	1
B-108	0;	0;	0;	0;	0;	1	0;	0;	0;	0;	0;	0;	0;	0;	0;	0;	1	0;	1
HB-383	1	0;	0;	0;	0;	0;	0;	0;	0;	2	0;	1-2	1	1-2	0;	1	0;	1	2
HD-85	0;	0;	0;	0;	0;	0;	0;	0;	0;	1	0;	1	1	1	0;	1	0;	1	1
HD-94	0;	0;	0;	0;	0;	0;	0;	0;	2	0;	0;	1	0;	1	0;	1	0;	0;	1
HD-96	0;	0;	0;	0;	0;	0;	0;	0;	0;	1	0;	1-2	0;	1	0;	1	0;	1	1
HD-2257	0;	0;	0;	0;	0;	0;	0;	0;	0;	2	0;	1	1	0;	0;	1	0;	1	1
HI-687	0;	0;	0;	0;	0;	1	1	0;	0;	0;	0;	1	0;	1	1	2-3	1	2-3	1
HI-693	0;	0;	0;	0;	0;	0;	0;	0;	0;	2	0;	0;	0;	0;	1	0;	1	1	1
HI-732	0;	0;	0;	0;	0;	0;	1	0;	0;	2	0;	0;	0;	0;	1	1	1	1	0;
HI-761	0;	0;	0;	0;	0;	0;	0;	1	0;	2	0;	1	0;	1	1	0;	0;	1	1
HI-763	4	0;	1	4	3	0;	1	0;	3	0;	2-3	0;	0;	0;	0;	0;	0;	0;	1
HI-768	1	0;	1	0;	0;	0;	1	0;	1	2	0;	0;	0;	0;	0;	0;	0;	1	0;
HI-784	0;	0;	0;	0;	2	1	0;	0;	0;	1	0;	1	0;	0;	1	1	0;	0;	1
HI-788	2+	0;	1	0;	0;	0;	0;	1	0;	3	0;	1	2	0;	0;	1	0;	1	1
HI-803	4	0;	0;	3	0;	0;	0;	0;	4	3	3	1	0;	0;	0;	1	0;	0;	1
HI-839	0;	0;	2	0;	1	1	0;	1	1	0;	0;	1	0;	1	0;	0;	0;	0;	1
HI-840	1	3	2	0;	1	1	0;	1	0;	1	2-3	1	0;	1	0;	0;	0;	0;	1
K-7643	0;	0;	0;	0;	2	1	0;	1	0;	4	0;	2	2	0;	3	0;	2	1	1
MP-311	0;	0;	0;	0;	0;	0;	0;	0;	1	0;	0;	1	0;	1	0;	1	2	1	1
P-94	1	0;	0;	3	2	1	0;	2-3	0;	0;	2	1	0;	2	0;	1	0;	1	1
Raj 1575	0;	0;	0;	0;	0;	1	0;	0;	0;	2	0;	1	0;	1	1	0;	0;	1	1
Raj 1582	0;	0;	0;	1	0;	0;	1	1	0;	1	0;	1	1	1	1	0;	2	0;	1
Raj 1595	0;	0;	0;	0;	0;	1	0;	1	0;	1	0;	1	0;	1	0;	0;	0;	1	2-3
Raj 1608	0;	0;	0;	0;	0;	0;	0;	2-3	0;	1	0;	1	0;	0;	0;	1	0;	1	1
Raj 1633	1	0;	0;	0;	0;	0;	0;	1	2	4	0;	1	0;	0;	1	0;	0;	1	1
Raj 1654	0;	0;	0;	0;	0;	0;	0;	1	0;	3	0;	4	0;	0;	0;	1	0;	1	1
Raj 1663	1	0;	0;	0;	0;	1	0;	0;	0;	0;	0;	1-2	0;	0;	1	0;	0;	1	1
Raj 1665	0;	0;	1	0;	0;	1	0;	0;	0;	1	0;	1	0;	0;	0;	1	0;	1	1
Raj 1675	0;	0;	1	0;	0;	1-2	0;	0;	0;	0;	1	1	1	1-2	0;	0;-1	0;	0;	1
Raj 1679	1	0;	0;	1	0;	0;	0;	0;	0;	1	0;	1	0;	1	0;	1	0;	0;	1

Table 4 - Reactions of various entries to individual races of stem leaf of wheat

Entries	Races of leaf rust of wheat																		
	10	11	12	12A	12B	17	20	63	77	77A	77A-1	104	104A	104B	106	107	108	162	162A
B-86	0;	0;	0;	1	x	0;	0;	0;	1	0;	1	0;	1	x	0;	0;	0;	0;	0;
B-108	-	0;	0;	1	2	0;	0;	0;	1	1	0;	0;	1	2	0;	0;	0;	0;	0;
HB-383	-	0;	2	0;	x	0;	1	0;	0;	4	3	3	0;	0;	2	0;	1	3	1
HD-85	0;	0;	0;	1	2	0;	0;	0;	0;	1	1	0;	0;	x	0;	0;	0;	0;	0;
HD-94	0;	0;	0;	1	x	0;	0;	0;	0;	0;	1	1	0;	2	0;	0;	0;	0;	0;
HD-96	0;	0;	0;	1	2	0;	0;	0;	1	0;	1	0;	0;	x	0;	0;	0;	0;	0;
HD-2257	0;	0;	0;	2	x	0;	0;	0;	1	0;	0;-1	2	0;-1	x	0;	0;	0;	0;	0;
HI-687	0;	0;	0;	0;	0;	0;	0;	0;	0;	0;	1	x	0;-1	4	0;	0;	0;	0;	0;
HI-693	x	0;	0;	0;	x	1	x	0;	3	3	3	x	x	x	0;	0;	x	0;	0;
HI-732	x	0;	0;	0;	1	0;	0;	0;	0;-1	1	1	0;	0;-1	x	0;	0;	1	0;	0
HI-761	x	0;	0;	0;	0;	4	x	0;	3	3	-	x	x	x	0;	0;	x	0;	0;
HI-763	0;	0;	4	x	4	0;	0;	0;	4	4	4	0;	4	4	0;	0;	0;	3	x
HI-768	x	0;	4	x	4	1	0;	0;	1	4	-	2	x	4	-	x	0;	x	3
HI-784	1	0;	0;	0;	0;	x	2	0;	4	2	2	0;	x	2	0;	0;	1	0;	0;
HI-788	0;	0;	0;	0;	0;	0;	0;	0;	1	0;	1	0;	0;	3	0;	0;	0;	0;	0;
HI-803	0;	0;	x	x	4	0;	0;	0;	4	4	4	x	4	4	0;	0;	0;	4	x
HI-839	0;	0;	4	x	4	0;	0;	0;	3	x	x	2	x	4	0;	0;	0;	0;	0;
HI-840	0;	0;	3	x	x	0;	0;	0;	x	x	x	1	4	x	1	0;	0;	3	2
K-7643	1	0;	0;	0;	0;	0;	1	0;	x	4	4	1	2	2	0;	0;	2	0;	0;
MP-311	-	0;	0;	1	x	0;	0;	0;	1	1	2	0;	1	x	0;	0;	0;	0;	0;
P-94	x	0;	x	x	x	0;	0;	0;	x	4	4	2	2	x	0;	0;	x	x	x
Raj-1575	2	0;	2	x	x	0;	1	0;	4	3	4	2	x	4	0;	x	x	2	x
Raj-1502	0;	0;	1	1	1	0;	1	1	2	4	x	0;	0;	1	0;	0;	1	2	0;
Raj-1595	x	1	2-3	1	2	2-3	1	0;	4	4	4	2	x	x	0;	1	2	2	2
Raj-1608	-	0;	x	0;	2	2	-	0;	x	3	x	0;	0;	x	0;	0;	0;	2	x
Raj-1633	x	0;	0;	x	0;	x	1	0;	4	x	x	x	x	x	0;	0;	x	0;	0;
Raj-1654	0;	0;	0;	2	0;	x	0;	0;	0;	-	x	1	2	x	0;	0;	0;	0;	0;
Raj-1663	x	0;	0;	2	2	x	1	0;	4	4	4	x	0;	3	0;	-	2	2	x
Raj-1665	0;	0;	0;	0;	0;	0;	0;	0;	0;	x	x	0;	0;	2	0;	0;	1	0;	-
Raj-1675	0;	0;	0;	0;	0;	0;	0;	0;	0;	4	x	x	x	x	0;	0;	0;	0;	0;
Raj-1679	2	0;	x	x	4	1	x	0;	x	4	3	x	4	4	0;	3	4	x	4

Not recorded.

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BREEDING OF SPRING BARLEY FOR RESISTANCE TO LEAF RUST AND OTHER DISEASES IN CZECHOSLOVAKIA

BY

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Old Czechoslovakian spring barley cultivars were developed mainly by selection from land races from the Hana region. They had a high malting quality but were very susceptible to powdery mildew. Therefore breeding for powdery mildew resistance was started 25 years ago. The following genes for resistance were used in the first stage of breeding for disease resistance:

Ml-a1 donor Rabat
Ml-a3 donor Ricardo
Ml-a9 donor Monte Cristo
Ml-a1a donor 125/HOR 805/
Ml-at donor Anatolie 516
ml-o donor Abyssinicum 6
Abyssinicum 1105

In the second stage of breeeding, medium resistance in lines HOR 1402, KM 1192, Ab. 1128, CI 7672, CI 9588, and combinations of several genes for resistance were applied.

Successful breeding for powdery mildew resistance led to a higher susceptibility to barley leaf rust. Therefore breeding

for combined resistance to barley leaf rust and powdery mildew had to be initiated. The leaf rust race survey showed that Baladi and Aim (Pa-3) were the best sources for resistance breeding. Gene Pa-3 from Baladi 16 and Aim, gene Pa-7 from Capa and Gondar, gene Pa-9 from Ab. 14 and another undescribed gene from HOR 1873 were used in breeding for leaf rust resistance. At the same time the following donors of net blotch resistance were used: CI 5791, CI 7584, KM 1192, R 1218 and R 1320.

In 1970 the first lines that combined powdery mildew and leaf rust resistance were developed. Three of these lines were included in the Expanded European Disease Nursery. Line E 1388 has the Ml-a9 gene for powdery mildew resistance and a gene for leaf rust resistance from HOR 1873. The line F 784 contains the Ml-a13 and Pa-9 genes and has also yellow rust resistance. The line I 265 has genes Ml-a13 and Pa-3.

In 1981 three other lines possessing Pa-3 were included in the Expanded European Disease Nursery. They are also resistant to powdery mildew. In the line P 1323, mildew resistance is derived from CI 7672, in U 1878 from HOR 1402 and in Z 730 from CI 9588. Many other lines combining genes Pa-3 or Pa-7 with various powdery mildew resistance genes were developed.

The first Czechoslovakian cultivar with combined powdery mildew and leaf rust resistance was the cultivar Karat, containing genes Ml-a13 and Pa-3. It was released in Czechoslovakia in 1981 and licenced also in the German Democratic Republic. It is being tested in the Federal Republic of Germany, Netherlands and England.

Another disease which increased in importance after the development of leaf rust and powdery mildew resistant lines was

barley net blotch. The number of resistant lines to net blotch is limited. Resistance from KM 1192, R 1218 and CI 14373 was combined with powdery mildew.

The last disease for which breeding for resistance was commenced was Rhynchosporium secalis Oud. Until now resistance to Rhynchosporium secalis derived from cultivars Koru and Magnum has been combined with powdery mildew resistance.

Experience with barley breeding for disease resistance started 25 years ago, and has shown that only a combined resistance to several pathogens can assure the desirable protection of barley from diseases.

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FIELD BEHAVIOUR OF WHEATS WITH REGARD TO RUSTS IN ITALY DURING 1981

BY

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For the eighth consecutive year, field observations on the behaviour of wheat with regard to disease have been carried out in critical areas of Northern, Central and Southern Italy.

During the 1980-81 season 920 varieties and lines of both durum and bread wheat were grown in 10 different locatons. The material under study also included 358 durum and 109 bread wheat lines bred by 14 Italian private and public research Institutions.

Low temperatures and drought during winter coupled with delayed spring rainfall did not favour the build-up of severe epidemics of stripe rust (present only at Rieti) and stem rust (low level attacks observed only at Rome, Rieti and Badia Polesine).

Of greater practical significance was the damage caused by leaf rust, particularly at Cagliari, Rieti, Badia Polesine, S. Angelo Lodigiano.

Table 1 summarizes the percentage of green tissue damaged by the rusts in each location (only susceptible check varieties have been considered).

The levels of infection caused by stripe and stem rust were not enough to evaluate precisely the behaviour of wheat genotypes with regard to these diseases; only very susceptible new lines could be discarded.

Resistance to leaf rusts has been confirmed (in trials from 1974 to 1981 - see references) for the following varieties: Abe, Aurora, Bonanza, Chris, Clement, Drina, Era, Ga-B691 ora 2 Ga 1123/Rud Nuguains, Kenya Cross (Turkey), L707 Louisiana Wakeland/Blueboy (F.7), Purdue 5724 BE-3P-8-2-43, Russalka, Sage (Kansas), T. P. 114/65A, and Yecora 70 among bread wheats and Belvedere, Karel, Valforte, Valgerardo, Valitalico, Valriccardo, Valselva and Valnera among durums.

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TABLE 1 - PERCENTAGE OF GREEN TISSUE DAMAGED BY RUSTS IN EACH LOCATION DURING 1981 (MEAN VALUES)

LOCATION	LATITUDE	ALTITUDE	PUCCINIA STRIIFORMIS CHECK VARIETY 'NOVOSADSKA 1993'	PUCCINIA RECONDITA CHECK VARIETY 'FORTUNATO'	PUCCINIA GRAMINIS CHECK VARIETY 'FORTUNATO'
1. GELA (CL)	37° 05'	10	-	-	-
2. CALTAGIRONE (CT)	37° 10'	500	-	-	-
3. CAMMARATA (AG)	37° 30'	460	-	-	-
4. CAGLIARI	39° 10'	96	-	41	-
5. ORISTANO	39° 55'	0	-	-	-
6. FOGGIA	41°	76	-	-	-
7. ROMA	42°	162	-	-	43
8. RIETI	42° 30'	405	9	60	55
9. BADIA POLESINE (RO)	45°	11	-	55	24
10. S. ANGELO LODIGIANO (MI)	45° 10'	16	-	45	-

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FIELD BEHAVIOUR OF WHEATS WITH REGARDS TO RUSTS IN ITALY DURING 1982

BY

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During 1982, the 9th national wheat disease nursery was grown in 12 different locations of Northern, Central and Southern Italy. The material examined, nearly 1200 wheat genotypes, included 420 new lines derived from various Italian public and private breeding programmes.

Low levels of stem and stripe rust inoculum at the beginning of the season and drought (especially in southern Italy) hindered the development of severe epidemics of these fungi.

Leaf rust attacks (observed in 7 locations) were generally moderate or irrelevant, except at Bellizzi, Montelibretti and Rieti.

Table 1 summarises the percentage of green tissue damaged by the rusts in each location (only susceptible check varieties have been considered).

A list of varieties found to be resistant to the leaf rust population present in Italy is published in another article (Cereal Rusts Bulletin Vol. 11. Part 1, 1983).

Stripe and stem rust attacks during the past two seasons have not been heavy enough to evaluate precisely the behaviour of wheat genotypes included in the nurseries for the first time

during 1980 and 1981.

However the results obtained from 1974 to 1980 clearly indicate that all bread wheat varieties presently cultivated in Italy are susceptible to both stem and stripe rust. During the same period varieties of various origin, such as, Abe, Bonanza, Chris, Kavkaz, Pato-Tzpp-Son.64 x Nor.59, Wisconsin Supremo, Yecora 70, Inia 66 and Era have shown resistance to stem rust; Lerma Rojo 64A, Pato Tzpp-Son.64 x Nor.59 and Asosan demonstrated resistance to stripe rust.

Only Belfuggito, Karel, Valaniene, Valitalico, Valoriolo and Valsacco, among durums, showed resistance to stem rust. Belfuggito, Belvedere, Creso, Valoriolo, Valsacco, Valgerardo, Valforte, Polesine, Maristella, Isa I, Triminia and Numina demonstrated resistance to stripe rust.

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TABLE 1 - PERCENTAGE OF GREEN TISSUE DAMAGED BY RUSTS IN EACH LOCATION DURING 1982 (MEAN VALUES)

LOCATION	LATITUDE	ELEVATION (m.)	PUCCINIA STRIIFORMIS CHECK VARIETY 'NOVOSADSKA 1993'	PUCCINIA RECONDITA CHECK VARIETY 'FORTUNATO'	PUCCINIA GRAMINIS CHECK VARIETY 'FORTUNATO'
1. CALTAGIRONE (CT)	37° 10'	500	-	-	-
2. CAMMARATA (AG)	37° 30'	460	-	-	-
3. CAGLIARI	39° 10'	96	-	-	-
4. ORISTANO	39° 55'	0	-	48	-
5. FOGGIA	41°	76	-	-	-
6. BELLIZZI (SA)	40° 30'	0	-	78	-
7. ROMA	42°	162	-	62	-
8. MONTELIBRETTI (RM)	42°	30	-	86	-
9. MONTERONTONDO (RM)	42°	60	-	36	45
10. RIETI	42° 30'	405	54	77	55
11. BADIA POLESTINE (RO)	45°	11	-	63	-
12. S ANGELO LODIGIANO (MI)	45° 10'	16	-	-	-

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THE IMPORTANCE OF THE TURKISH TRAP NURSERY (TTN) FOR MONITORING WHEAT AND BARLEY DISEASES

BY

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Cereals, especially wheat and barley are widely grown in Turkey. In fact they are the main food source for the people and also serve as food for livestock either as grain or forage pasture.

Increased production by growing disease resistant, high yielding, stable varieties with improved management practices and better protection against pests and pathogens is the basic goal of the "Turkish Winter Cereals Research Project" centred in Ankara.

There are three major environments in Turkey; the areas growing winter wheats, the areas growing spring wheats and the areas growing facultative wheats. Because of the variability in the wheat environment, new farming practices, new cultivars and increased irrigation in wheat producing areas, changes in the pathogen situation often result. Therefore the project needed a disease monitoring system, and a country wide disease surveillance programme was started in 1971. In the fall of 1970 the first TTN was conducted by many co-operators in different locations. Since then the same nursery with a slightly changed composition has been grown each year. The nursery contains commercial varieties grown in Turkey, promising lines, isogenic lines plus a number of resistant and susceptible lines or varieties.

The objectives of TTN are:

(a) to monitor the disease situation on a country wide basis to help predict and prevent epidemics.

(b) to determine the virulence potential of the pathogen population and to observe the reaction of the cultivars and promising lines to these diseases and their races.

(c) to keep track of the movement of disease through locations and regions.

(d) to determine the influence of the commercial varieties on the selection and increase of virulence of the various diseases.

Data collected from TTN since 1971 are summarized as follows:

(1) Major diseases of wheat were the rusts, and of barley the leaf blights. Stripe rust was the most destructive. Secondly stem rust which could cause epidemics when conditions were favourable. Leaf rust was of little importance in most parts of the country, but it was significant in the west transitional zone of Anatolia, Mamara region and Aegean. Helminthosporium was becoming a major problem in barley. Rhynchosporium leaf blight was often observed but not economically important.

(2) Soil borne wheat mosaic virus was first detected in the Alpu valley of Eskisehir in 1971. Since then it had become increasingly important and recently it was observed in the northern part of Anatolia.

(3) Once strawbreaker (eyespot) caused economic damage in Thrace. It was still prevalent in some locations, especially in the irrigated areas of the west transitional, and Marmara region.

(4) Powdery mildew of barley and wheat was a serious problem in Marmara.

(5) Septoria tritici was one of the most important diseases of the coastal region, especially in the Aegean, although epidemics were rare.

(6) Loose smut damage on wheat and barley was about 2-5% But in some years the amount of loss increased, in relation with the environmental conditions in the previous year, to as high as 15%

(7) Fungicide applications resulted in a significant decrease in the amount of loss from bunt on wheat but there are locations in east Anatolia where wheat is still sown without fungicide treatment and damage occurs. Also faulty fungicide treatment was often observed.

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THE RUST SITUATION IN SWITZERLAND, 1981 AND 1982.

By P M Fried

Swiss Federal Research Station for Agronomy, Recknenholz, Zurich

The incidence of yellow rust of wheat has been declining during the past years and was found in only one field at Rutti/BE in 1982.

Leaf rust of wheat was found across the country in both years, but appeared only very late in the growing season. Yield reductions are therefore estimated to be very low. Nevertheless, there is a danger of an earlier outbreak of the disease, as it has been observed during the fifties.

Stem rust of wheat has not been found in farmer's fields in 1981 but was identified in one sample from Delley/VD in 1982. In general, this disease is limited to some alpine valleys where the alternate host is wide spread.

Crown rust of oats rarely attacks the crop when it is grown for grain production. However, it is often found when planted late in summer as a forage crop in mixtures with gramineae and leguminosae.

SIXTH EUROPEAN AND MEDITERRANEAN CEREAL RUSTS CONFERENCE
Grignon/FRANCE, 1984

At the 1980 Cereal Rusts Conference in Bari, France was elected as the host country for the next Cereal Rusts Conference. We shall be pleased to welcome you in France.

Date: 4th to 7th September 1984.
Place: Grignon (78000), FRANCE, some kilometers West of Versailles, in the buildings of the Institut National Agronomique Paris-Grignon (INA-PG) - Railway Station: Plaisir-Grignon, from Paris-Montparnasse.

Provisional Programme

Monday 3rd September	: Arrivals, accommodation, registration
Tuesday 4th September	: Opening, Conference session Evening: Visit of the Palace of Versailles and welcome party.
Wednesday 5th September:	Conference Session and Posters Session
Thursday 6th September	: Conference Session Evening: Conference dinner
Friday 7th September	: Conference Session Evening: Closing of the Conference

Official languages: English and French
Contribution: The speakers will be limited in time; 10 minutes for the papers and 5 minutes for discussion.

Conference report: A Conference report containing the abstracts of the papers would be prepared before the Conference.

Conference fee: Depending on the number of participants, about 1,200 FF, covering registration, Conference report, visit of the palace and Conference dinner.

Ladies programme: Will be prepared upon request and depending on the number.

Accommodation: In the Students House of Grigon there are single rooms for 120 persons and a dozen double rooms for couples. The charges for board and lodging will amount approximately 240 FF a day.

If there are more participants, rooms could also be booked in Hotels in Versailles but at a higher price.

Official currency: French Franc (F.F.)
Issue of next information: Second circular (including the detailed program and the Final Registration Form) January 1984.

Questions: If you have any questions, please contactus, we try to help you.

Address of the organisers:
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- Dr. F. RAPILLY, Station de Phytopathologie
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