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EPIDEMICS OF YELLOW RUST ON WHEAT IN ITALY

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The disease nurseries which the Istituto Sperimentale per la Cerealicoltura (Rome) and the Istituto di Patologia Vegetale (Bari) have been carrying out during the last 5 years (1974-8) in different parts of Italy, include both durum and bread varieties, cultivars carrying known genes for resistance and new lines derived from various Italian breeding programmes. The aim of these nurseries is to provide breeders in Italy with phytopathological and genetical information about the reactions of this material to Puccinia recondita, P. graminis, P. striiformis and Erysiphe graminis (Zitelli et al., 1974; Sisto et al., 1975; Sisto et al., 1976; Cariello et al., 1977; Siniscalco et al., 1978).

The data collected so far indicate that yellow rust, which is traditionally considered a minor disease in Italy where it is therefore not taken into consideration during the selection of new wheat varieties, may constitute a greater menace than was previously thought. In fact, epidemics have been observed in our trials in 1974, 1975 and especially during 1977 and 1978.

During the first year (1974), P. striiformis was present at each of the 12 trial locations, but severe epidemics were observed only at Foggia and at Leonessa (Table 1). At the latter location, the percentages of leaf area infected on the susceptible control varieties (cvs. Novosadska 1993, Fortunato and Michigan Amber) were 80, 73 and 99 per cent respectively. The disease did not spread uniformly throughout the trial and the reactions of the wheats could not therefore be accurately compared. As a whole, durum wheats were very much less attacked than hexaploid cultivars. Of the bread wheats, Irnerio, a variety covering a large portion of the wheat area in Italy at that time, was the most severely affected by yellow rust (80 and 99 per cent infection at Foggia and Leonessa, respectively).

In 1975, pustules of P. striiformis were observed in several of the 19 trials, particularly at Agnone (800 m above sea level) and Leonessa (974 m above sea level), but the disease was almost totally absent

Table 1. Yellow rust on selected varieties in Italian disease nurseries in 1974, 1977 and 1978

	VARIETIES OR LINES	Percentage of leaf area infected					
		1974*		1977**		1978***	
		Mean	Max	Mean	Max	Mean	Max
I	SUSCEPTIBLE CONTROLS						
	Novosadska 1993	55	80	83	88	82	93
	Fortunato	53	73	55	81	69	78
	Michigan Amber	45	99	78	99	90	99
II	COMMON WHEAT VARIETIES GROWN IN ITALY						
	Inerio	90	99	79	99	99	99
	Marzotto	0	0	33	60	48	60
	Libellula	-	-	72	90	23	40
	S. Pastore	35	40	64	80	70	90
	Argelato	17	30	40	50	73	80
	Lohtra	20	30	58	80	48	70
	Adria	-	-	24	60	30	70
	Mec	-	-	32	50	62	80
	Gallini	-	-	74	80	70	90
	Aquileia	-	-	62	90	50	80
	Flaminio	60	60	62	90	75	90
	Valle d'Oro	-	-	43	99	82	99
	Sanya	-	-	29	70	75	90
	Orso	-	-	62	99	60	70
	Florio	-	-	55	90	55	70
	Alpe	-	-	48	90	88	90
III	COMMON WHEAT VARIETIES SHOWING LOW DEGREE OF INFECTION						
	Magnif MG	0	0	15	40	13	50
	Bonanza	0	0	2	5	3	10
	Kavkaz	-	-	0	40	0	0
	Lovrin 13 (Romania)	-	-	0	TR	0	0
	WWP 7147 (Austria)	-	-	6	10	10	40
	Renacimiento	0	0	15	30	20	40
	Lerma Rojo 64A	-	-	10	30	0	TR
	A. Intermedium derivate	0	0	3	10	0	TR
	Pato Tzpp-Son 64x Nor 59	-	-	11	30	0	0
	2 Ga 1123/Rud Nuguains	-	-	2	10	0	0
	Atle	0	0	19	40	8	30
	Compair	0	0	12	30	0	TR

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* Means of two locations: Rieti (Leonessa), Foggia
** Means of five locations: Rieti, Roma, Foggia, Cagliari, Sassari
*** Means of four locations: Rieti (Leonessa), Rieti, Roma, Salerno (Bellizzi)

	VARIETIES OR LINES	Percentage of leaf area infected					
		1974*		1977**		1978***	
		Mean	Max	Mean	Max	Mean	Max
IV	SELECTED COMMON WHEAT VARIETIES						
	Maris Widgeon	0	0	37	90	15	50
	Joss Cambier	-	-	56	90	20	80
	Heines Kolben	0	0	62	99	25	50
	Chino 166	0	0	40	70	25	70
	Vilmorin 37	10	20	32	70	23	50
	Vilmorin 329	0	0	40	60	80	99
	Lee	-	-	-	-	10	40
	Selkirk	0	0	64	90	35	70
	Thatcher	0	0	64	90	53	80
	Bezostaya 1	-	-	20	40	48	60
	Drina	-	-	39	70	93	99
	Centurk	-	-	58	90	48	90
	Sentinel (Nebraska)	-	-	30	50	30	60
	Sava	-	-	47	70	63	80
V	DURUM WHEAT VARIETIES GROWN IN ITALY						
	Capeiti	-	-	30	60	8	30
	Cappelli	10	20	28	50	0	TR
	Appulo	0	0	19	40	23	40
	Grifoni (B.52)	0	0	25	60	3	10
	Creso	0	0	5	20	0	TR
	Trinakria	-	-	17	40	3	10
	Montanari	10	20	19	40	0	0
	Raineri	0	0	25	40	0	TR
	Maristella	5	10	13	30	7	20
	Isa 1	-	-	16	30	10	30
	Tito	0	0	22	40	10	10
	Belfuggito	0	0	7	30	0	0
	Hymera	0	0	22	40	10	30
	Belvedere	-	-	8	20	3	10
	Conte Morando	15	30	44	90	45	70
	Rio	-	-	23	40	67	90
	Gabbiano	-	-	16	30	13	40
	Ranger	-	-	32	50	3	10
	Riente	-	-	32	50	7	20
	Lambro	30	40	10	40	0	TR
	Valaniene	0	0	16	60	3	10
	Valgiorgio	0	0	9	30	3	10
	Valsacco	0	0	3	10	0	0
	Valfiora	0	0	10	40	3	10
	Valnera	20	40	13	40	5	20
	Valgerardo	0	0	7	20	0	TR
	Valselva	5	10	15	50	3	10
	Valnova	0	0	11	40	28	70
	Valitalico	0	0	26	70	-	-

Continued ...

	VARIETIES OR LINES	Percentage of leaf area infected					
		1974*		1977**		1978***	
		Mean	Max	Mean	Max	Mean	Max
VI	OLD ITALIAN DURUM VARIETIES						
	Marzuolo Cervone	0	0	29	50	23	40
	Minutola	7	10	13	30	20	40
	Triminia	0	0	16	30	8	30
	Nummina	0	0	5	10	5	10
VII	DURUM WHEATS OF VARIOUS ORIGINS						
	Cocorit 71	15	30	14	40	5	20
	Rolette	-	-	48	70	75	99
	Ward	-	-	46	60	77	99
	Yuma	0	0	35	70	55	80
	Lakota	0	0	38	50	50	80
	Wells	0	0	58	70	33	70
	ST 464	0	0	56	70	50	80
	Gaza	0	0	21	70	70	80
	Kyperounda x Kambourico	0	0	53	90	63	70
	Claro Fino (Albacete	0	0	39	80	30	60
	Claro de Balazote (Albacete)	-	-	40	70	30	60
VIII	MISCELLANEOUS SPECIES						
	Einkorn C.I. 2433	0	0	13	30	7	30
	T. Timopheevi C.I. 11802	-	-	1	5	0	0
	T. Timopheevi W 1899	-	-	1	5	0	0
	K.29548 T. Timopheevi Zhuk Var. Typicum Zhuk AAGG	0	0	0	0	0	0

at all sites during the following year (1976). The exceptionally mild summer of 1976, however, has no doubt favoured the build of the severe epidemic of yellow rust in 1977. The trials carried out during that year showed that all the bread varieties that are at present grown in Italy are susceptible (Table 1). Irnerio, the highest yielding variety in Italy, agai.. suffered the heaviest yellow rust epidemics on farmers' fields; in several parts of Central Italy this cultivar was not harvested at all because of yellow rust damage and yields were very much below average in the North also.

During 1978, although a few pustules were observed at most locations, yellow rust epidemics occurred in only four of our nurseries, Bellizzi, Rome, Rieti, and Leonessa (Table 1).

The most resistant of the 15 Italian bread wheat varieties examined during the period 1974-78 were Marzotto and Adria, but even these varieties were badly damaged by yellow rust at some locations. Of the foreign hexaploid varieties, Kavkaz, Lovrin 13 (both of which carry a 1B/1R rye substitution), Bonanza, Lerma Rojo 64A, "A. intermedium derivat", Pato-Tzpp-Son 64 x Nor. 59, Ga B691 (2 Ga. 1123/Rud. Nuguains), Magnif MG, WWP 7147, Renacimiento, Atle and Compair showed low levels of infection, while other cultivars, including Maris Widgeon, Joss Cambier, Chinese 166, Vilmorin 37, Sentinel, Bezostaya 1 and Heines Kolben, suffered attacks of medium intensity.

As had already been observed in 1974, most durum varieties grown in Italy (except Conte Morando and Rio) expressed a higher level of resistance to yellow rust than the bread wheats. Tetraploid wheats of foreign origin, on the other hand, and especially St. 464, Kyperounda x Kambourico C.S. 50-20, Sentry and N.S. 33 Baladi Saidi, became severely infected.

Our results show that P. striiformis is potentially more damaging than P. graminis or P. recondita in Italy. It is difficult however to decide what priority should be given to yellow rust in our breeding programmes in Italy because according to past records, the epidemics observed during the last few years seem to have been exceptional. Moreover, the known sources of resistance to yellow rust are relatively few, and the use of some of these appears rather dangerous because they have been used in varieties which are widely cultivated in neighbouring countries.

Although the frequency of specific virulence genes in a pathogen population depends largely on the resistance genes carried by the host

cultivars in that region (Johnson, 1961), the presence of the disease in different seasons and its relative economic importance can be influenced also by relatively small climatic variations and by modifications of cultural practices. No doubt the long cool springs of 1977 and 1978 in Italy created favourable conditions for yellow rust, high temperatures normally limiting the disease under Italian conditions. The large-scale cultivation of a very susceptible variety, Irnerio, may also have contributed to the severity of the yellow rust attacks observed.

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