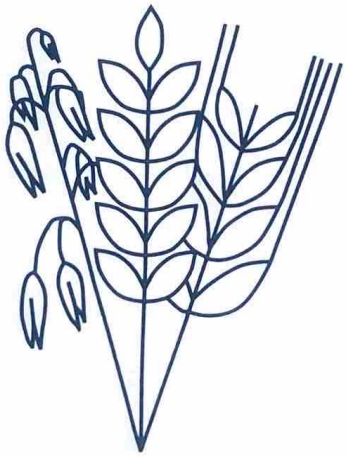
Protection of Cereal Crops against Harmful Organisms



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Effectiveness of wheat genes for stem rust resistance

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Abstract

The most effective genes of wheat to stem rust resistance in Yugoslavia in 1995 and 1996 were Sr 9e (98.76-100%), Sr 11 (88.82-96.76%), Sr 26 (92.55-96.30%), Sr 29 (95.66-99.54%), Sr 31 (93.17-94.45%), Sr 32 (82.61-95.84%) and Sr 33 (99.08-99.38%).

WHEAT, GENES, STEM RUST, EFFECTIVENESS, RESISTANCE

Introduction

The wheat stem rust, caused by *Puccinia graminis* Pers. *f. sp. tritici* Erikss. *et* Henn., has been observed in many locations in Yugoslavia. It occurs frequently in hilly regions in which the vegetation period is longer. However, intensity of its attack is relatively low and epidemics have not been noticed for a long time.

The use of resistant cultivars is the most effective, economical and enviromentally safe means of control. The base for a succesful selection of wheat for resistance to the agent of stem rust is the knowledge of host- parasite interaction.

The aim of this study was to assess the effectiveness of wheat genes for resistance to different pathotypes of stem rust in Yugoslavia.

Materials and methods

In 1995 and 1996 resistance of 23 near isogenic lines to 377 isolates were investigated in Center for Smal Grains at Kragujevac. Lines with single genes for resistance Sr 5, Sr 6, Sr 7b, Sr 8a, Sr 9b, Sr 9e, Sr 9g, Sr 11, Sr 17, Sr 21, Sr 30 and Sr 36 were used for determination of pathotypes (Rolfs and Martens, 1988) and Sr 13, Sr 22, Sr 24, Sr 25, Sr 26, Sr 27, Sr 29, Sr 31, Sr 32, Sr 33 and Sr 37 were complementary.

Urediospore samples were collected in several locations from different wheat cultivars. After primary infection on susceptible cultivars, 1-3 monopustular cultures from each of 168 samples were separated and multiplied. The inoculated plants of isogenic lines were kept in a moisture chamber. After 24 hours the plants were transfered to a greenhouse at the temperature 18-25^{o}C.

Infection types (0-4) were recorded 10-15 days after inoculation (Stakman *et al.*, 1962).

Results

The results of the investigation are shown in Table 1. The most effective genes were Sr 9e, Sr 11, Sr 26, Sr 29, Sr 31, Sr 32 and Sr 33. Virulence frequences of these genes fluctuated between 0 and 17.39%. In 1995 there was no infection in Sr 9e, one isolate was virulent for Sr 29 and two for Sr 33. However, in 1996 we detected two virulent isolates for Sr 9e, seven for Sr 29 and one for Sr 33. Genes Sr 13, Sr 17, Sr 22, Sr 24, Sr 25, Sr 30 and Sr 36 (40.74-87.97%) were moderatly effective. The other investigated genes (Sr 5, Sr 6, Sr 7b, Sr 8a, Sr 9b, Sr 9g, Sr 21, Sr 27 and Sr 37) indicated a low degree of effectiveness (3.71-40.38%). There were no significant differences in effectiveness of some Sr genes between years.

Discussion

The results reported here are in agreement with the literature citated. McIntosh *et al.* (1995) summared resulta of different autors and reported that virulence occurs at high frequency for genes Sr 5, Sr 6, Sr 7b, Sr 8a, Sr 9b, Sr 9g, Sr 13, Sr 17, Sr 21, Sr 27, Sr 30 and Sr 36 in most geographic areas. On the other hand high degree of effectiveness manifested lines with genes Sr 9e, Sr 11, Sr 26, Sr 29, Sr 31, Sr 32 and Sr 33.

In international collections did not find virulence cultures for Sr 24 as well as for Sr 22 in Mexico and USA. However, this results demonstrated moderate effectiveness of Sr 22 and Sr 24 genes. Roelfs and Groth (1986) proved low effectiveness for Sr 5, Sr 7b, Sr 9a, Sr 9d, Sr 10, Sr 15, Sr 16, Sr 17, Sr 36 and high effectiveness for Sr

6, Sr 9b, Sr 9e and Sr 11 genes. These results demonstrate that all of investigated Sr genes have allels of virulence in population. The number of virulences accumulated are generally much higher than the number of resistance genes present in the cultivars grown (Parlevliet, 1996). Pedigree of many effective genes, including Sr 9e, Sr 11, Sr 26, Sr 31 and Sr 33 originate from kind of soft wheat. Formation of new virulence in the population of wheat rust causes the loss of specific resistance. That is why it is important to know effectiveness of Sr genes in stage of adult plants for breeding to resistance.

Tab. 1. Effectiveness of Sr genes for resistance to *Puccinia graminis tritici*

Sr gene	1995			1996		
	V	A	%	V	A	%
Sr 5	194	22	10.19	155	6	3.73
Sr 6	202	14	6.49	152	9	5.59
Sr 7b	208	8	3.41	156	5	3.11
Sr 8a	146	70	32.41	96	65	40.38
Sr 9b	150	66	30.56	102	59	36.65
Sr 9g	197	19	8.80	141	20	12.43
Sr 9e	0	216	100.00	2	159	98.76
Sr 11	7	209	96.76	18	143	88.82
Sr 13	26	190	87.97	47	114	70.81
Sr 17	120	96	44.45	72	89	55.28
Sr 21	207	9	4.17	151	10	6.22
Sr 22	1o6	110	50.93	69	92	57.15
Sr 24	73	143	66.21	25	136	84.48
Sr 25	112	104	48.15	49	112	69.57
Sr 26	8	208	96.30	12	149	92.55
Sr 27	184	32	14.82	146	15	9.32
Sr 29	1	215	99.54	7	154	95.66
Sr 30	128	88	40.74	38	123	76.40
Sr 31	12	204	94.45	11	150	93.17
Sr 32	9	207	95.84	28	133	82.61
Sr 33	2	214	99.08	1	160	99.38
Sr 36	84	132	61.12	23	138	85.72
Sr 37	176	40	18.52	155	6	3.73

V-number of virulent isolates, A-number of avirulent isolates, % - percentage of effectiveness

References

McIntosh,R.A.,Wellings,C.R.,Park,R.F.(1995):Wheat rusts and atlas of resistance genes.CSIRO, Australia.

Parlevliet, L.E. (1996): Reproduction systems of biotrophic and hemibiotrophic fungal leaf pathogens and their cosequences for breeding for resistance. Proc. of the 9th Europ. and Medit. Cereal Rust and Powdery Mildew Conf., p.71-76. The Netherlands.

Roelfs, A.P., Groth, J.V. (1980): A comparision of virulence phenotypes in wheat stem rust populations reproducing sexually and asexually. Phytopathology, 9:855-862.

Roelfs, A.P., Martens, J.W. (1988): An international system of nomenclature for *Puccinia graminis f. sp. tritici*. Phytopathology, 5:526-533.

Stakman, E.C., Stewart, D.M., Loegering, W. (1962): Identification of physiologic races of *Puccinia graminis tritici*. USDA-ARS, E-617, p. 1-53.