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Races of Puccinia graminis f. sp. tritici in the Russian Federation in 2007.

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The wheat stem rust pathogen, having an extremely high ability to evolve new, virulent phenotypes (such as Ug99), is one of the most important monitored pests that needs annual control in cereal-growing countries. Last year in the Russian Federation, the survival strategy of *P. graminis* f.sp. *tritici* was to emphasize barberry and wild grasses being limited on the wheat cultivars (Lekomtseva et. al. 2007).

In the summer of 2007, unfavorable conditions controlled the spread of stem rust in the European part of the Russian Federation (Central Region and Northern Caucasus) and Western Siberia. The average temperature was about 22ºC with 45% relative humidity in June–July. Local wheat cultivars were quite resistant to stem rust under these climactic conditions.

Barberry was heavily infected by *P. graminis* f.sp. *tritici* in all these regions during May and the first week of June. Furthermore, in early autumn, wild grasses (*Elytrigia*, *Phleum*, and *Festuca*) were severely damaged by wheat stem rust. The spores of *P. graminis* f.sp. *tritici* from barberry and wild grasses were collected and multiplied on the susceptible wheat cultivar Khakasskaya. Race identification of 32 monouredinial isolates of *P. graminis* f.sp. *tritici* was carried out using the standard technique of infection of 20 wheat lines, which were supplied by the USDA–ARS Cereal Disease Laboratory, St. Paul, Minnesota, USA, in 2005.

In Pgt nomenclature (Roelfs and Martens 1988), six races of *P. graminis* f.sp. *tritici* were revealed among the geographical samples (Table 1), and all phenotypes were combined in the single, highly virulent, Stackman's race 15. Race TKNTF (15) dominated in the different regions of the Russian Federation with a frequency of 75% in populations of the fungus.

Table 1. Races of *Puccinia graminis* f.sp. *tritici* in some regions of the Russian Federation in 2007.

Race	Area	Plant host	Number of isolates
TKNTF	Central area	barberry	18
	Northern Caucasia	barberry	1
	Central area	couch grass	4
	Central area	fescue	1
TKSTF	Central area	barberry	1
TTSTF	Northern Caucasia	barberry	1
PKNTF	Northern Caucasia	barberry	1
TTNTF	Northern Caucasia	barberry	1
	Western Siberia	barberry	1
TKNRF	Central area	couch grass	2
	Central area	timothy grass	1
Total			32

The race composition of *P. graminis* f. sp. *tritici* on barberry in Northern Caucasus was significantly different from that in Central Russia and Western Siberia. Only two races were found in Central Russia with TKNTF (15) dominating. TKNTF also was prevalent in Western Siberia. No race was dominant of the five virulent phenotypes identified in the Northern Caucasus region, although one of these races was TKNTF (15). Intensive sexual process provides high variability of race composition on barberry in the mountains of Northern Caucasus. This determines this region as the most infective source of different virulent phenotypes of stem rust pathogen for cereal grasses. In Central Russia, race TKNTF dominated on coach grass (*Elytrigia*), timothy grass (*Phleum*), and fescue (*Festuca*) in addition to barberry. The virulent phenotype TTKS (Ug99) was not fixed in 2007 and was not found before (Lekomtseva et al. 2004, 2007). Some of the *Sr* genes of wheat, *Sr9b*, *Sr13*, *Sr24*, and *Sr31* were resistant to all stem rust isolates in 2007 (Table 2). Gene *Sr11* was susceptible during 2001–05 but is now resistant. All these genes are recommended for plant-breeding programs to use agains the wheat stem rust pathogen in the Russian Federation.

Table 2. Virulence of isolates of *Puccinia graminis* f.sp. *tritici* to Sr lines of wheat 2007 in the Russian Federation (%).

Gene	%	Gene	%	Gene	%	Gene	%
Sr5	100.0	*Sr9b*	9.3	*Sr11*	21.0	*Sr31*	0.0
Sr6	100.0	*Sr9c*	100.0	*Sr13*	00	*Sr36*	100.0
Sr7b	100.0	*Sr9d*	100.0	*Sr21*	97.0	*Sr38*	100.0
Sr8a	100.0	*Sr9e*	100.0	*Sr24*	0.0	*SrTmp*	100.0
Sr9a	100.0	*Sr10*	100.0	*Sr30*	100.0	*SrWld*	100.0

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Encapsulating winter wheat seed.

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Encapsulating seed creates a macronutrient environment for starting seed. The surface of seed adsorbs NPK and this is more effective than adding to in soil nearby. However, the negative effect of this method is an increase in the osmotic concentration of solution and the high sensitivity of seedlings.

Materials and methods. Seedlings of winter wheat were grown for 10 days at 21°C in plastic cups. Before germination, the seeds were encapsulated with four different solutions: 1 – H_2O, 2 – a 1% soluble, complex fertilizer (NPK), 3 – a 2.5% soluble, complex fertilizer (NPK), and 4 – a 5% soluble, complex fertilizer (NPK).

Results and discussion. The swelling dynamics of seed and the change in the seed humidity in first four days of growth depended upon the concentration of the treatment solution. High concentrations of solution diminished the speed of germination substantially (Fig. 1). The first negative effect observed on the encapsulated seeds was a decline in germination (Fig. 2, p. 180). Increasing the concentration of the treatment solution caused a decline in seed germination (black) and multiplied the number of seed that perished after primary germination (white) (Fig. 2, p. 180).

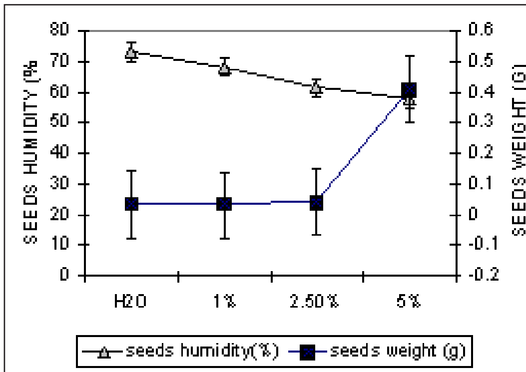

Fig. 1. Change in humidity and weight of seeds depending on concentration of an encapsulation solution (Control is H_2O only).