

drograms (mean taxonomic distance, UPGMA), irrespective of their changes caused by experimental stress. In the dendrogram (Fig. 15), three groups of grasses, namely the amphiploids, *H. vulgare*, and *B. secalinus*, are distinctly separated. Appropriate pairs (s vs. z) also are distinctly separated. Only the AGA amphiploid is differentiated more by the environmental stress. Development of the abaxial epidermis of palea and lemma was most often disturbed in amphiploids. Under drought conditions, high temperature, and starvation, the grass plant developed only one tiller with short spike or poor panicle. Tissues were highly sclerified. Under sufficient watering, the plants were often infested by fungi and setting of caryopses was defective. In conclusion, both environments can create a stress of various nature. Thus, the microstructure of cereals is shifted under heavy stress, but its general pattern is preserved. Then, this pattern can be a good basis for any taxonomic comparisons.

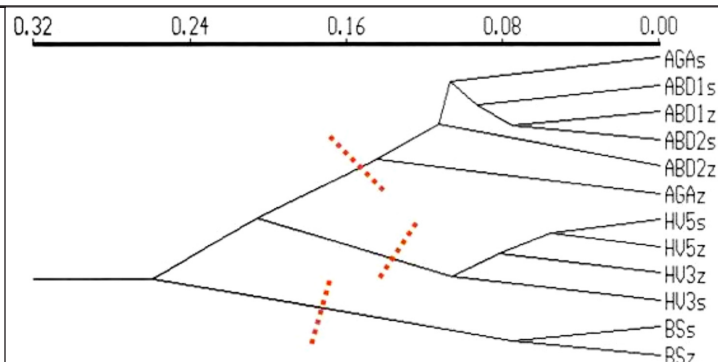


Fig. 15. A dendrogram (Canberra distance, UPGMA) of cereal OTUs described by glumellae and lodicule microstructure (*Triticum* amphiploids having genomes AAGGAA (AGA) and AABBDD (ABD1 and ABD2), and two cultivars of *Hordeum vulgare* (HV3 and HV5) and *Bromus secalinus* (BS)). Taxa are distinctly clustered (red dashed lines).

ITEMS FROM THE RUSSIAN FEDERATION

AGRICULTURAL RESEARCH INSTITUTE FOR THE SOUTH-EAST REGIONS

Department of Genetics, Laboratory of Genetics and Cytology, 7 Toulaiikov St., Saratov, 410010, Russian Federation.

The evaluation of spring bread wheat cultivars, NILs, and introgression lines in the hard, drought conditions of 2009–10.

S.N. Sibikeev, A.E. Druzhin, V.A. Krupnov, T.D. Golubeva, and T.V. Kalintseva.

For the recommendation of introgression lines with identified combinations of genes for resistance to pathogens in practical breeding some prebreeding research is necessary. These research includes determining resistance to abiotic stresses and bread-making qualities. The conditions of the growing periods of 2009 and 2010 allowed estimating the set of introgression lines for drought resistance. The two-year-old data for grain productivity in NILs in the extremely hard drought conditions have shown the following results. The combination of *Lr9+Lr19*-translocations in the genotypes of cultivars L503, Dobrynya, and line L2032, do not depress yielding ability, but *Lr19+Lr26* significantly improves grain productivity, and *Lr19+Lr24* and *Lr19+Lr25* significantly depresses yield ability. A neutral reaction for grain productivity in the introgression lines with substitution 6Agi (6D) is detected. The incorporation of genetic variability from *T. turgidum* subsp. *dicoccoides* and *dicoccum* to the spring bread wheat cultivars Saratovskaya 58 and Saratovskaya 55 (lines L196 and L2870) does not depress drought resistance, but incorporation of genetic variability from durum wheat (cultivars Saratovskaya zolotistaya, Lyudmila, and Saratovskaya 57) to bread wheat (lines L200/09 and L211/09), and their combination improves this trait. The NILs with combinations of translocations *Lr9+Lr19*, *Lr19+Lr24*, *Lr19+Lr25*, substitution 6Agi (6D), and also lines L196, L2870, L200/09, and L211/09 have good bread making quality at the level of cultivars. The NIL of L503 with combination of *Lr19+Lr26* translocations was exception in which the flour strength was reduced.

The evaluation of spring bread wheat introgression lines of the Genetics and Cytology Laboratory at ARISER in breeding for resistance to leaf and stem rust.

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In the 2010 growing season, a set of introgression lines was estimated for resistance to leaf and stem rusts on the experimental fields of the Institute of Cytology and Genetics (Academgorodok, Novosibirsk, Russia) and for resistance to race Ug99 + Sr24 (TTKST) of stem rust in the KARI, Njoro, Kenya under natural epidemic conditions. We detected that the NILs with translocation combinations *Lr19+Lr24* and *Lr19+Lr26*, and also lines L196, L2870, L200/09, and L211/09, are resistant to leaf and stem rusts, including to Ug99. Thus, the efficiency of combinations *Lr19/Sr25+Lr24/Sr24* and *Lr19/Sr25+Lr26/Sr31* and also the unidentified leaf and stem rust genes in lines L196 and L2970 has been shown. In lines L196 and L2870, the probability is very high that the leaf and stem rust genes are linked, because during breeding of these lines, selections were conducted only for resistance to leaf rust.

The dynamics of population change *Puccinia triticina* at ARISER, Russian Federation, during 2008–10.

S.N. Sibikeev and A.E. Druzhin.

The climatic change in the Volga Region was all the more noticeable by its influence on the composition of the population *P. triticina*, which is considered one of the most virulent. Analysis of *P. triticina* population dynamics during 3 years (2008–10), showed that it is quite responsive to increases in air temperature. The study of leaf rust population composition was carried out in a greenhouse on NILs of Thatcher with differing *Lr* genes. Inoculations in the greenhouse were performed at the optimum temperature (20–22°C) using uridospores that were collected in the field on susceptible cultivars of winter wheat. During 2008, the air temperature did not exceed the critical value for the pathogen (31°C) for virtually the entire season (Fig. 1); and a majority of virulent pathotypes were present in the population (Table 1).

Since 2009, the has situation changed. The air temperature during the period of infection in field conditions is often higher than the critical indicator for the pathogen or is above the optimal value. This has led to the fact that in the population of the fungus eliminated or reduced their virulence the following pathotypes: pp11, pp14b, pp19, pp24, pp32, and pp40. In 2010, when temperatures during the vegetative period were very high (35–40°C) and in a hard drought (Fig. 1), significant changes were noticed

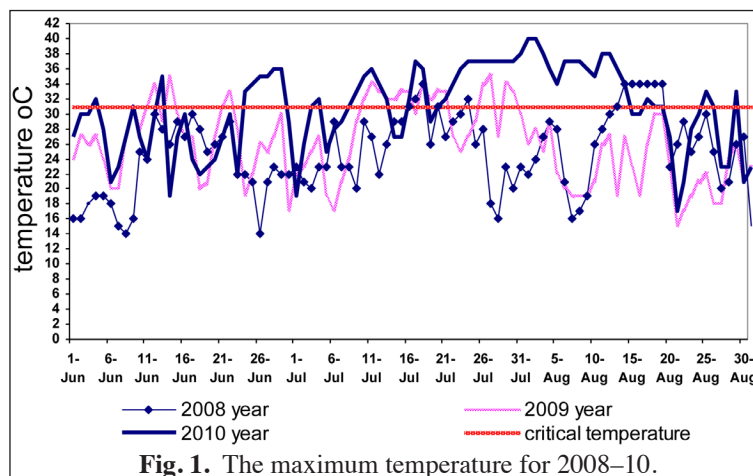


Fig. 1. The maximum temperature for 2008–10.

Table 1. The dynamics of change of the formula avirulence/virulence in populations of *Puccinia triticina* at the Agricultural Research Institute for the South-East Regions, Russian Federation, in 2008–10.

Year	Avirulence/virulence formula
2008	9, 17a, 29, 28, 41, 42/2a, 2b, 2c, 3a, 3bg, 3ka, 10, 11, 12, 13, 14a, 14b, 14ab, 15, 16, 18, 19, 20, 21, 22a, 23, 24, 25, 26, 27+31, 30, 32, 33, 34, 37, 38, 40, b, H
2009	9, 11, 14b, 19, 24, 28, 29, 32, 40, 41, 42/2a, 2b, 2c, 3a, 3bg, 3ka, 10, 12, 13, 14a, 14ab, 15, 16, 17a, 18, 20, 21, 22a, 23, 25, 26, 27+31, 30, 33, 34, 37, 38, b, H Infection type: 0; 1: 14b, 19, 32 22+: 40 2+3: 11
2010	2b, 2c, 3a, 3bg, 3ka, 9, 10, 11, 12, 13, 15, 16, 17a, 19, 21, 24, 28, 29, 30, 32, 41, 42, H/2a, 14a, 18, 20, 22a, 23, 27+31, 37, 38, 14b, 14ab, 33, 34, b Infection type: 0; 1: 9, 21, 32 1: 2c, 12, 13, 29 11+: 2b, 16 1+2: 3a, 11 2+: 3bg, 3ka, 10, 15, H 2+3: 30

in the *P. triticina* population. In the pathogen population, there was eliminated or decreased virulence for the following pathotypes: pp2b, pp2c, pp3a, pp3bg, pp3ka, pp10, pp11, pp12, pp13, pp15, pp16, pp17a, pp19, pp21, pp24, pp30, pp32, and ppH. It is interesting that the following virulent pathotypes remained in the population: pp2a, pp14a, pp18, pp20, pp22a, pp23, pp27+31, pp37, pp38, pp14b, pp14ab, pp33, pp34, and ppb, which showed high adaptability to high temperature and were drought resistant.

Effects of interaction 6Agi (6D) chromosomes from *Thinopyrum intermedium* and *Lr19* translocation from *Th. elongatum* on flour protein content spring bread wheat.

O.V. Krupnova, S.A. Voronina, V.A. Krupnov, and A.E. Druzhin.

On leached, chernozem soil with a crop rotation (a bare fallow–spring bread wheat), flour protein content varied from 13.9% up to 20.3% and gluten content from 30% up to 48%. In these conditions, near isogenic lines for chromosome 6Agi (6D) from *Th. intermedium* and an *Lr19* chromosome 7D translocation from *Th. elongatum* had a positive influence on flour protein content in spring bread wheat, both within a leaf rust epidemic and without.

In a population from crosses between parents JI400R and 6Agi(6D) and JI1089 and *Lr19*-T7D, we selected recombinant inbred lines JI204 and JI205, which have the combination *Lr19*-T7D and 6Agi(6D). In a population from crosses between parents JI2032 (*Lr19*-T7D) and JI400R, we are selected RILs JI108 and JI396, which have only 6Agi (6D). All four lines (JI204 and JI205, JI108, and JI396) are resistant to the Saratov population of a leaf rust and, on a grain yield and a flour protein yield per unit area, exceed that of the parents. For flour protein content, they are less than that of the parents. The mechanism of interaction, 6Agi(6D)/*Lr19* and *Lr19*/6Agi(6D), in a *T. aestivum* background, and the control of the decrease in flour protein content in the RILs, compared with the parents, are unknown.

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A new spring durum wheat cultivar ‘Nikolasha’ has been released in the Russian Federation.

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The State Commission on the Test of Breeding Achievements approved a new cultivar of spring durum wheat named ‘Nikolasha’ (137/00-5) for use in agricultural production in 2009–10. Nikolasha appears well adapted to southern and southeastern areas of European part of the Russian Federation, such as the Krasnodar, Rostov, and Saratov regions. The cultivar was developed thanks to the joint breeding program between P.P. Lukyanenko Krasnodar Research Institute for Agriculture (KRIA) and Agricultural Research Institute for the South-East Regions (ARISER).

Cultivar Nikolasha was developed as a result of individual plant selection in the F_2 generation from the hybrid population obtained by crossing the line D-2033 with the cultivar Nick (D-2029) at ARISER. The line D-2033 was derived from a cross between two highly drought-resistant local lines Leucurum 1863 and Leucurum 1945. The cultivar Nick was derived from a cross between Saratovskaya zolotistaya and Altayskaya Niva. The local cultivar Saratovskaya zolotistaya has very high quality grain and pasta products. The cultivar Altayskaya Niva originated from the Altay region and is highly resistant to common bunt and loose smut. The elite plant was selected in the F_8 generation at KRIA in 2001. The field test of the line 137/00-5 was conducted in Krasnodar in 2004–05.

The spike of Nikolasha is white with white awns, pyramidal in shape, and of medium length (6–8 cm) and density (26–27 spikelets/10-cm rhachilla). Kernels are amber and vitreous. The 1,000-kernel weight was 38–46 g and test weight was 770–822 grams/L. Plants have good resistant to lodging. Plant height is 100–115 cm, which is 5 cm lower than that of the standard cultivar Novodonskaya. Plant heading is earlier than that of Novodonskaya by 1–2 days.

The cultivar is very drought resistant. Nikolasha has a high level of disease resistance, particularly to common bunt and loose smut; good field resistance to leaf, stripe. and stem rust; septoria leaf spot; and tolerant to root rot if sown after such fore crops as winter wheat and barley.

Nikolasha durum wheat is a widely adapted cultivar. The cultivar combines high potential productivity and drought resistance. In 2008, the yield in main trials at KRIA (Krasnodar) reached up to 6.28 t/ha against 4.74 t/ha for the check Kharkovskaya 17. In 2004–06, the average productivity of Nikolasha in the main trial was 5.14 t/ha, which was higher than that of the check cultivar Novodonskaya by 0.37 t/ha. In the Saratov field test in the 2010 spring wheat growing season when the hydrothermal coefficient for May–July in the Volga River Region was very low (0.1–0.2), which corresponds to an extremely strong drought, Nikolasha gave a grain yield of 0.75 t/ha, compared to 0.33 t/ha for the Saratovskaya zolotistaya check. This new cultivar has good physical grain parameters and strong gluten quality. For 2008–10, the average SDS-sedimentation index was estimated up to 50 mL, similar to that of Saratovskaya zolotistaya. Durum wheat Nikolasha is good achievement of ARISER and KRIA shuttle breeding program and according to the technological suitability for the pasta industry after the official testing it was also approved as an original cultivar for the dry, southeast areas of the Russian Federation (Saratov) in 2010 from the State Variety Testing Commission.

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Anther culture method of creating initial breeding stocks for triticale selection at ARISER.

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The generation of doubled haploid (DH) plants via anther culture is an important biotechnological method, which permits significant shortening of the breeding process. This technique speeds up the time of cultivar development by several years. Different intervarietal and wheat-triticale hybrids (F_2 – F_3 generation) based on the local triticale and wheat cultivars were used for haploid production in this study. The undoubled haploid plants were served by microclonal propagation using a somatic embryogenesis method.

The created DH lines were studied in a traditional breeding process. The winter hexaploid cultivar Student from the Volga region serves as standard cultivar. The triticale breeding program at ARISER works to solve the problems of reducing abiotic and biotic stress influence on the plant growth and increasing yield capacity and grain quality.

In a short time, using traditional and biotechnological approaches, some advanced DH lines of hexaploid triticale were developed. They differ from each other by several botanical and agronomical characteristics, yield capacity, quality of the grain, plant height, and vegetative period. In 2010, Sviatosar, a new winter triticale created by combining conventional and haploid breeding was submitted to the state variety tests. This cultivar was derived from cross of local line with the Krasnodar cultivar Strelets. The higher yield capacity of Sviatosar is mainly due to a higher 1,000-kernel weight (Table 2).

Table 2. Grain yield, 1,000-kernel weight, and plant height of the new triticale cultivar Sviatosar.

Cultivar	Grain yield (t/ha)					1,000-kernel weight (g)	Plant height (cm)
	200	2008	2009	2010	Average	Average 2007–10	
Sviatosar	3.21	3.69	3.23	1.62	2.94	44.4	130
Student-St	2.81	3.17	2.89	1.08	2.48	38.2	130
LSD ₀₅	0.36	0.38	0.30	0.30	0.30	2.4	—

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Breeding of spring wheat in Saratov.

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In 2009–10, spring bread wheat cultivars from different wheat breeding centers of the Russian Federation, Germany, Belarus, and Kazakhstan were studied in the field trials at the Agricultural Research Institute for the South-East Region (ARISER, Saratov). The modern cultivars developed in the ARISER were used as a check. Grain yield of old Saratov cultivars (introduced into agricultural production in 1924–57) was 43.8% that of the modern cultivars. The closest yields to those the modern ARISER cultivars were those from Samara (Russia), the grain yield of which reached 66.9%. Yield capacity of cultivars from the relatively dry regions of Russia (Ufa, Orenburg, Kurgan, and Barnaul) and Kazakhstan was 53.9–55.1% that of the Saratov cultivars. Grain yield of Moscow Region's cultivars made up only 51.1%, whereas that of cultivars developed in the relatively moist regions of Germany and Belarus comprised 36.5% that of the Saratov cultivars (Table 3).

Table 3. Yield capacity of spring bread wheat cultivars produced by different wheat breeding centers in 2009–10.

Region where the cultivar was created	Grain yield capacity	
	t/ha	%
Saratov (modern cultivars)	1.78	100.0
Saratov (historically developed cultivars)	0.78	43.8
Samara	1.19	66.9
Ufa, Orenburg	0.98	55.1
Kurgan, Barnaul, Kazakhstan	0.96	53.9
Moscow	0.91	51.1
Germany, Belarus	0.65	36.5
LSD05	0.39	—

These data demonstrate that the bioclimatic potential of Saratov Region is most fully used by Saratov spring bread wheat cultivars. The cultivars created in other regions are less adaptive. The farther they are in their origin in time or space from the modern Saratov cultivars, the lower the yield capacity. To get optimal use from the bioclimatic potential of the region, the reach of regional breeding centers should be created and developed. The distance between them will depend on the agro-climatic differences between the regions. An increase of 10–15% of the modern local cultivars yield capacity over those developed in neighboring regions may be used as an indicator of the working efficiency of any regional breeding center.

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Joint inheritance of resistance to leaf rust, spike productivity, and stem length in hybrid soft wheat plants.

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The soft wheat winter cultivar Moscovskaya 39 is characterized by a complex of valuable agronomic features. The cultivar is high-yielding and winter-hardy, and its grain quality is very good. However, Moscovskaya 39 is not resistant to leaf rust. Our aim was to provide resistance to leaf rust from a disomic substitution ($2n = 42$) wheat–*Aegilops* line (DSL) using a backcrossing technique. The disomic substitution line was selected from a hybrid population '*T. aestivum*/*Ae. speltoides*' (Kyzlasov et al. 2004) that is resistant to leaf rust.

The 'Moscovskaya 39/DSL' hybrid F_1 , as well as the DSL itself, proved to be completely resistant to leaf rust. Resistance in the DSL is dominant. The 'Moscovskaya 39/DSL//Moscovskaya 39' F_1 hybrid segregated for resistance