also is different in the depicted taxa. In the genus *Avena* (Fig. 32 D–J, p. 119), some additional shapes of the nucellar projection + endosperm cavity were detected (Fig. 32E and J). Ideograms (Fig. 32D, E, and F) prove that in an *Avena* amphiploid a change in the shape of nucellar projection + endosperm cavity structure occurs compared to the parental species. In *Avena* species, M-shaped endosperm cavities were noted (Fig. 32G and H). Xylem vessels can develop near the pigment strand (Fig. 32H) or at some distance (Fig. 32G). This difference could mostly affect the development of endosperm tissue.

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ITEMS FROM THE RUSSIAN FEDERATION

AGRICULTURAL RESEARCH INSTITUTE FOR THE SOUTH-EAST REGIONS (ARISER)
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The influence of alien genetic materials for grain productivity and bread-making qualities in NILs of spring bread wheat.

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

We have obtained sets of spring bread wheat NILs carrying alien Lr-genes at the Genetics and Cytology Laboratory at ARISER. These NILs have the following genetic material: *Lr19+Lr9*, *Lr19+Lr24*, *Lr19+Lr25*, *Lr19+Lr26*, *Lr19+Lr37*, and wheat–*Thinopyrum intermedium* substitution 6Agi (6D) and wheat–*Thinopyrum elongatum* substitution 3Age (3B). These sets of NILs have the *Lr* genes from *T. turgidum* subsps. *dicoccum* and *dicoccoides*. The vegetative period in 2013 was very wet and moderate leaf rust epidemics were observed. In these conditions, grains yield of the NILs carrying *Lr19+Lr9*, *Lr19+Lr24*, *Lr19+Lr25*, *Lr19+Lr26*, and *Lr19+Lr37* and the NILs with *Lr* genes from *T. turgidum* subsp. *dicoccum* were similar to those of other cultivars and lines, but the NILs with *Lr* genes from *T. turgidum* subsp. *dicoccoides* and the 3Age (3B) and 6Agi (6D) substitutions significantly higher at 2.89, 2.96, and 3.22 t/ha, respectively. For complex bread-making qualities, the NILs with *Lr19+Lr25* and *Lr19+Lr37* were the best. All the NILs were excellent for gluten content and strength. For flour strength (W), the minimum value was 196 (cultivar L503) and the maximum was 667 (L2032 (*Lr19+Lr24*)). As a whole, the presence of alien genetic material in the NILs has not worsened bread-making qualities and was estimated as good and excellent.

The genetic control of leaf rust resistance in the new spring bread wheat introgression lines.

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

New spring bread wheat introgression lines resistant to leaf rust have been produced by the Laboratory of Genetics and Cytology. The resistance has been transferred from *T. turgidum* subsps. *dicoccum* (k7507) and *dicoccoides* (k46216) and *T. kiharae*. During the 2011–13 seasons, the infection type to leaf rust of these lines was 0;–1. The genetic analysis has shown that the resistance transferred from *T. turgidum* subsp. *dicoccum* (k7507) and *T. kiharae* is determined by one dominant gene, but the resistance from *T. turgidum* subsp. *dicoccoides* (k46216) is controlled by two dominant, complementary genes. At present, BC_2 and BC_3 have been obtained with the spring bread wheat cultivars Saratovskaya 68, Saratovskaya 70, and Dobrynya.

The features of inheritance of T7DL-7Ae#1L-7Ae#1S translocations with Lr29 in Saratov-bred spring bread wheat cultivars.

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

During the 2005, 2007, 2008, and 2013 growing seasons, the high efficiency of the *Lr29* gene to populations of *Puccinia triticina* was shown. This gene is effective to *P. triticina* pathotypes virulent to *Lr19* (pp19). The infection type (IT) of *Lr29* was 11+. A NIL of Thatcher *Lr29* (TH Lr29) has been crossed with cultivars Saratovskaya 68 (S68) and Saratovskaya 70 (S70) (both cultivars do not have any *Lr* genes), and also with cultivars L503 and Dobrynya (DOBR) (both cultivars have *Lr19*). After inoculation with populations of *P. triticina* with high pp19 concentrations, segregating F_2 populations of the following were screened: BC_1 S68/TH *Lr29*, BC_2 S68/TH *Lr29*, BC_1 S70/TH *Lr29*, BC_2 S70/TH *Lr29*, BC_1 L503/TH *Lr29*, BC_2 L503/TH *Lr29*, BC_1 DOBR/TH *Lr29*, and BC_2 DOBR/TH *Lr29*. The *Lr29* gene is inherited in a monogenic dominant manner in the combinations with cultivars Saratovskaya 68 and Saratovskaya 70. An excess of susceptible plants was observed in the crosses with L503 and Dobrynya, and the ratio of resistant to susceptible plants not fit a 3R:1S ratio, indicating partial suppression of *Lr29* by *Lr19*. This conclusion agrees with earlier studies. However, earlier reports of the suppression of *Lr29* by *Lr19* were after inoculation by population or pathotypes of *P. triticina* not virulent to gene *Lr19* and observed ITs characteristic for *Lr19*. In our case, after inoculation with pp19, we observed that *Lr19*, or unknown genes in the translocations, reduce the protective action of *Lr29* and increase the number of susceptible plants; the IT of resistant plants is 11+.

The analysis of structure productivity of spring bread wheat introgression lines of the Laboratory of Genetics and Cytology, ARISER.

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The Laboratory of Genetics and Cytology, ARISER, produced a set of introgression lines for increasing the genetic variability of spring bread wheat. These introgression lines were obtained from crosses between bread wheat and various related donor species from the primary, secondary, and tertiary gene pools. To successfully work with these lines, characterization, both cytogenetically and genetically, is important. However, the definitive agronomical value of these lines can be found during prebreeding research including the analysis of productivity structure. Preliminary analysis of the introgression lines in spring bread wheat has shown that *Thinopyrum intermedium* chromosome 6Agi increases plant height, spike length, and number of spikelets, and lodging resistance is high. In the future, we will expand this research.

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Response of wheat seedlings interacting with glycosylated flagellins of the plant endophyte bacterium Azospirillum irakense KBC1.

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Plants grow and develop in an environment formed and densely populated by bacteria. However, plants exhibit homeostasis, restraining bacterial colonization of their inner tissues. Flagellin, a structural protein that forms the flagellar filament of motile microorganisms, is a bacterial molecule triggering a cascade of biochemical-defense reactions in plants. The interaction of bacterial flagellins with specific plant receptors leads to a considerable increase in the intracellular concentration of hydrogen peroxide and decreases the level of metabolism and the growth rate (Chinchilla et al. 2007). One factor of bacterial evolution necessary for the successful colonization of macroorganisms is the method of overcoming the immune system of plants. An example of such a mechanism is flagellin glycosylation, which reduces the probability that flagellin will be recognized by receptors.

We investigated the effect of flagellin from the growth-promoting rhizobacteria *Azospirillum irakense*, strain KBC1, on seedlings of soft spring wheat cultivar Saratovskaya 29. This endophyte bacterium was isolated from rice (*Orysa sativa* L.) roots (Khammas et al. 1989). Earlier, we showed that the polar flagellum flagellin of *Az. irakense* KBC1 is a glycoprotein and the residues of rhamnose, mannose, and galactose are present in the carbohydrate fragments of its flagellin at a 3:1:2 ratio, which is the same ratio as that found to exist between these sugars in the KBC1 O-specific polysaccharide (Fedonenko et al. 2004).

When 3-day-old wheat seedlings were treated with a bacterial flagellin solution (10.0 μg/mL), root length and root dry weight were inhibited considerably, –65% and –55%, respectively, and the mitotic index of the root meristem cells decreased twofold. When the seedlings were treated with different flagellin concentrations (0.01, 0.1, and 1.0 μg/mL), no statistically significant differences in the mitotic index compared with the control plants were observed. The morphometric parameters changed slightly; the root dry weight decreased by 9% and 15% for the 0.1 and 1.0 μg/mL solutions, respectively. For the glycosylated flagellin of the *Az. irakense* KBC1 polar flagellum, 10.0 μg/mL (~10^{-7} M) was found to inhibit plant growth, which is a concentration two orders of magnitude higher than the concentrations of nonglycosylated flagellins inhibitory to the growth of *Arabidopsis* (Chinchilla et al. 2007). One can speculate that the glycosylation of *Azospirillum* flagellins is one of the most important traits necessary for the successful colonization by *Azospirillum* of plants, including their inner tissues.

In summary, this study is the first to detect responses in the innate immune system of wheat to treatment with a bacterial flagellin, indicating the presence of receptors that recognize microbe-associated molecular patterns. The present results may be useful in understanding the molecular mechanisms of plant-microbe interactions and also in choosing plant microsymbionts and in developing bacteria-based fertilizers in agrobiotechnology.

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Specific action of bacterial lipopolysaccharide on the embryogenic ability of wheat calli in in vitro culture.

A comparative study on the effect of lipopolysaccharide (LPS) of the associative, plant-growth-promoting bacterial strains *Azospirillum brasilense* Sp245 and enterobacteria *Escherichia coli* K12 on the morphology of somatic calli of spring wheat was conducted *in vitro*. For this purpose, we used a genetic model including two near-isogenic lines of the wheat cultivar Saratovskaya 29 that differed in the *RhtB1c* gene and had contrasting embryogenic capacity. Calli were obtained on Linsmaier-Skoog medium with 2 mg/L of 2,4-dichlorophenoxyacetic acid (2,4-D) from immature (14-day old) wheat germ. In the experimental treatments, the standard medium, after being autoclaved, received 10 μg/mL of LPS, isolated from the bacterial outer membrane. The resulting calli were transplanted on a regeneration medium of the same composition without 2,4-D, but containing kinetin and indoleacetic acid in the amount 0.5 mg/L.

In preliminary studies, we found that LPS bacteria *A. brasilense* Sp245 in a concentration of 10 μg/mL stimulated the secondary processes of differentiation and regeneration capacity of wheat callus cells, thus increasing the efficiency of this genotype's low embryogenic potential (Tkachenko et al. 2012; 2013). We confirmed that the introduction of LPS *A. brasilense* Sp245 in to the medium increased calli formation with effecting meristematic activity and the regenerative capacity of cultured tissues. The introduction of bacterial LPS *E. coli* K12 to the nutrient medium did not cause similar effects. Yield of morphogenic calli and regenerated plants in the presence of the LPS did not differ from those of the control.

Based on our data, the LPS of the associative bacterium *A. brasilense* Sp245 has physiological activity against wheat callus cells unlike the LPS from *E. coli* K12. We note that these results are consistent with those obtained earlier when LPS and the bacteria *A. brasilense* Sp245 and *E. coli* K12 were exposed to the root system of wheat seedlings in *in vivo* experiments (Evseeva et al. 2011). Perhaps this difference is determined by the specificity of the mechanisms of action of LPS associative bacteria.

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