# THE PRESENCE AND THE ORIGIN OF 1BL/1RS TRANSLOCATION IN BREAD WHEAT CULTIVARS BRED IN SERBIA

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***Abstract:***

*Bread wheat cultivars with a 1BL/1RS translocation are used in many breeding programs throughout the world to improve grain yield and cultivar stability and adaptability. Unfortunately, serious defects in bread-making quality such as poor mixing tolerance, superficial dough stickiness, and low bread volume have been associated with this translocation. The presence of 1BL/1RS translocation in 68 bread wheat cultivars bred in Serbia was detected by SDS-PAG electrophoresis. 1BL/1RS translocation was present in 17 cultivars, although the two of them were heterogenous. Pedigree analysis revealed that the rye genes were introduced in to analysed cultivars from Aurora, Kavkaz and Skorospelka 35.*

***Keywords:***

*1BL/1RS translocation, bread-making quality, wheat, gel electrophoresis*

## 1. INTRODUCTION

The most widely spread translocations in wheat are those in which the short arm of rye chromosome 1 replaces the short arm of wheat group-1 chromosome. These whole-arm translocations developed from breakages of wheat and rye univalent chromosomes at the centromeres, followed by exchange and fusion of the respective chromosome arms (8). In European breeding programs, univalent 1R and 1B chromosomes would have coexisted in the initial hybrids between 1R(1B) substitution lines and euploid wheat (14). A long-term goal of breeders and geneticists has been to suppress the undesirable quality effects associated with having 1RS whole arm translocations. 1RS carries resistance genes to rusts (Lr26, Sr31, Yr9), (1, 4) and to powdery mildew (Pm8), (6), and to insects (10). Also, 1RS may directly increase yield (18). Conversely, depending of wheat genotype, 1RS chromatin can negatively impact wheat end-product, meaning reduction of flour yield (11) or production of undesirable 'sticky dough' (3). It was shown that two physically separated loci for rye seed endosperm proteins are present on 1RS, $\alpha$ and $\omega$ secalins. *Sec-1* locus is rather complex, and it has been estimated that at least 10 to

30 copies of the ω secalin structural gene are present, which appear to be associated with negative wheat end-product quality (1).

At least two, and perhaps three independent origins of 1BL/1RS translocations are known. The substitution line 'Zorba' gave rise to a number of 1BL/1RS translocations in former West Germany. The other substitution line 'Salzmünder Bartweizen' gave rise to a number of 1BL/1RS translocations in Eastern European breeding programs. Various breeding programs throughout the world distributed Kavkaz, a 1BL/1RS derivative of 'Salzmünder Bartweizen'. The third possible translocation was produced in Japan in the wheat 'Salmon' (4).

The aim of this study was to identify the presence and trace the origin of 1BL/1RS translocation in bread wheat cultivars bred in Serbia using SDS-PAG electrophoresis.

## 2. MATERIAL AND METHODS

Material: Sixty-eight bread wheat cultivars originated from Research Institute of Field and Vegetable Crops, Novi Sad, Serbia and Montenegro were used in the analysis. Cultivars Chinese Spring and Proteinka were used as negative or positive control, respectively.

Methods: The presence of 1BL/1RS translocation in different wheat cultivars was detected by sodium dodecyl sulphate polyacrylamide gel (SDS-PAG) electrophoresis of unreduced total seed proteins (15). After protein separation gels were stained using Commasie Brilliant Blue R-250 and electrophoregram was analyzed for presence of secalines, controlled by Sec-1 locus.

## 3. RESULTS

Proteins of single grain of 68 different bread wheat cultivars bred in Serbia were analyzed by method of SDS PAG electrophoresis. If 1BL/1RS translocation is present a secaline protein bands were visible at the upper part of the gel.

Among 68 wheat cultivars, 51 didn't expressed secaline protein subunits, meaning didn't posses 1BL/1RS translocation. Fifteen cultivars possessed 1RS rye chromatine, detected as secaline bands on the electrophoregram. Two cultivars, Anastasija and Selekta, showed intracultivar heterogenity. Cultivar Anastasija had 1BL/1RS translocation at 36% frequency, while Selekta showed the presence of translocation at 25% frequency (Table 1).

*Table 1. The presence of 1BL/1RS translocation in bread wheat cultivars bred in Serbia*

| | Cultivar | Year | 1BL/1RS presence |
|---|---|---|---|
| 1. | Danica | 1990 | - |
| 2. | Evropa 90 | 1990 | - |
| 3. | Pobeda | 1990 | - |
| 4. | Proteinka | 1990 | + |
| 5. | Kratka | 1991 | + |
| 6. | Novosadska 330 | 1991 | + |
| 7. | Novosadska rana 5 | 1991 | - |

| | | | |
|---|---|---|---|
| 8. | Bojana | 1992 | - |
| 9. | Desa | 1992 | + |
| 10. | Dicna | 1992 | - |
| 11. | Draga | 1992 | - |
| 12. | Jovana | 1992 | - |
| 13. | Kosuta | 1992 | - |
| 14. | Milica | 1992 | + |
| 15. | Slavija | 1992 | + |
| 16. | Srna | 1992 | - |
| 17. | Zlatica | 1992 | + |
| 18. | Atina | 1993 | - |
| 19. | Eva | 1993 | + |
| 20. | Fortuna | 1993 | + |
| 21. | Jarebica | 1993 | - |
| 22. | Rusija | 1993 | - |
| 23. | Slava | 1993 | + |
| 24. | Sloga | 1993 | - |
| 25. | Stepa | 1993 | - |
| 26. | Alfa | 1994 | - |
| 27. | Dejana | 1994 | - |
| 28. | Dina | 1994 | - |
| 29. | Divna | 1994 | - |
| 30. | Lira | 1994 | - |
| 31. | Luna | 1994 | - |
| 32. | Neva | 1994 | - |
| 33. | Renesansa | 1994 | - |
| 34. | Sasanka | 1994 | - |
| 35. | Stotka | 1994 | - |
| 36. | Stela | 1994 | + |
| 37. | Struna | 1994 | - |
| 38. | Suvaca | 1994 | + |
| 39. | Laguna | 1995 | - |
| 40. | Kremna | 1995 | - |
| 41. | Omega | 1995 | - |
| 42. | Pesma | 1995 | - |
| 43. | Prima | 1995 | - |
| 44. | Sila | 1995 | - |
| 45. | Silna | 1995 | + |
| 46. | Tera | 1995 | - |
| 47. | Tiha | 1995 | - |
| 48. | Bajka | 1997 | - |
| 49. | Dobra | 1997 | - |
| 50. | Galija | 1997 | - |
| 51. | Mina | 1997 | - |
| 52. | Prva | 1997 | - |
| 53. | Selekta | 1997 | 75% -/ 25% + |
| 54. | Senica | 1997 | - |
| 55. | Sreca | 1997 | - |

| | | | |
|---|---|---|---|
| 56. | Super rana | 1997 | - |
| 57. | Zlatka | 1997 | - |
| 58. | Delta | 1998 | - |
| 59. | Milena | 1998 | - |
| 60. | Sirena | 1998 | - |
| 61. | Sofija | 1998 | - |
| 62. | Sonja | 1998 | - |
| 63. | Anastasija | 1999 | 64% -/ 36% + |
| 64. | Ivanka | 1999 | - |
| 65. | Sara | 1999 | + |
| 66. | Stamena | 1999 | + |
| 67. | Ljiljana | 2000 | - |
| 68. | Sonata | 2000 | - |

Pedigree analysis for 15 cultivars that possessed 1BL/1RS translocation was performed, in order to trace the origin (Table 2).

*Table 2. The pedigree of cultivars possessing 1BL/1RS translocation*

| | Cultivar | Pedigree |
|---|---|---|
| 1. | Proteinka | NS 2726-2/Macvanka 1 |
| 2. | Kratka | Skopljanka/ZG 2463-74 |
| 3. | Novosadska 330 | Zl. dol./NSR-2//Partizanka |
| 4. | Desa | ((L-69-68/NS7000)/Mironov. Jubil 50)/NS7005 |
| 5. | Milica | Zelengora/Macvanka2//Partizanka |
| 6. | Slavija | NS 1987/Jugoslavija |
| 7. | Zlatica | NSR-2/Mutant 48//Sutjeska |
| 8. | Eva | Macvanka 2/VM 705-140 |
| 9. | Fortuna | Balkan/ZG 2597-76 |
| 10. | Slava | NS 27-97/VM 701-41 |
| 11. | Stela | NS 51-15/Balkan//Posavka 2 |
| 12. | Suvaca | MV 22-72/NS 32 |
| 13. | Silna | NS 7000/Zvezda |
| 14. | Sara | Partizanka/Jedina |
| 15. | Stamena | Lasta/Rodna |

## 4. DISCUSSION

The presence of 1BL/1RS translocation in cultivars bred in Serbia was proved in previous research, using different cytogenetical and biochemical methods (9, 12). SDS PAG electrophoresis confirmed the presence of 1BL/1RS translocation in 27% of analyzed cultivars bred in Serbia until 1990 (16). This research revealed the presence in 22% of cultivars bred in Serbia during last decade. Some cultivars possessing 1BL/1RS translocation are also known as cultivars resistant to leaf rust (17).

This research revealed 15 cultivars possessing translocation. Pedigree analysis revealed that at least one of parents of these also possesses 1BL/1RS translocation. Moreover, pedigree analysis revealed that the rye genes were most probably introduced into analyzed cultivars from Aurora, Kavkaz and Skorospelka 35.

Although alien chromatin carrying beneficial genes controlling resistance can be useful in wheat breeding programs (4), it also may have negative impact on wheat bread-making performance, as low specific loaf volume, the production of sticky dough, and lack of tolerance to overmixing (2, 7).

Careful selection of parents for crosses with known 1RS lines, coupled with rigorous selection for end-use quality, can diminish negative impact of 1BL/1RS translocation. In addition, the tools of genetic engineering can now be used to improve the quality of 1RS lines.

## 5. CONCLUSION

The presence of 1BL/1RS translocation in 68 bread wheat cultivars originated from Research Institute of Field and Vegetable Crops, Novi Sad, Serbia and Montenegro, was detected by SDS-PAG electrophoresis. 1BL/1RS translocation was discovered in 17 cultivars, although the two of them were heterogenous.

Pedigree analysis revealed that at least one of parents of cultivars with 1BL/1RS translocation originated from crosses involved Aurora, Kavkaz and Skorospelka 35 cultivars.

## 6. ACKNOWLEDGEMENTS

This research was partially funded by Ministry of Science, Technology and Development of Republic of Serbia, grant No. 1773.

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