# ELECTROPHORETIC COMPOSITION OF GLIADINS AND GLUTENIN SUBUNITES WITH HMW VARIETIES OF WINTER WHEAT (*T. AESTIVUM* L.) TESTED IN STATE VARIETAL TRIALS IN AUSTRIA

**J. Černý,[1] A. Šašek[2]**

[1]*Czech University of Agriculture, Faculty of Agronomy, Prague, Czech Republic*
[2]*Research Institute for Crop Production, Prague-Ruzyně, Czech Republic*

Electrophoretic analysis of gliadins and glutenin subunites with high molecular weight was realized in 72 varieties and new breeds of winter wheat (*Triticum aestivum* L.) tested in state varietal experiments by Bundesanstalt für Pflanzenbau, Vienna (Austria). 15 grains for each electrophoresis of gliadins and 5 for electrophoresis of glutenin subunites with HMW were randomly sampled from bulk seed samples, provided by Bundesanstalt für Pflanzenbau, Vienna. The grains were individually analyzed. Gliadins were analyzed by vertical column starch gel electrophoresis (Šašek, Sýkorová, 1989) and glutenin subunites with HMW by polyacrylamine gel electrophoresis (SDS PAGE) according to Laemmli (1960). Allelic gliadin and glutenin subunites with HMW blocks were excluded from electrophoretic spectra according to Sobko, Poperelja (1986) and Payne et al. (1981), respectively. Point values of baking quality prediction of single allelic blocks of gliadins and glutenin subunites with HMW were determined according to Černý et al. (1985) and Payne et al. (1987), Lukow et al. (1989) and Hammer et al. (1992), respectively. Genetic homogeneity and specificity of analyzed varieties and new breeds were evaluated by means of gliadin electrophoresis and glutenin subunites with HMW. Total 13.88% of analyzed numbers was heterogenic in gliadin composition and 11.11% heterogenic in glutenin subunites with HMW composition. Point values of baking quality prediction was determined for individual varieties and new breeds and their protein lines. A significant or highly significant correlation was proved between the baking quality and prediction point value of gliadin and glutenin allelic blocks – markers of baking quality. Individual varieties and new breeds were evaluated according to the occurrence of gliadin and glutenin markers of frost resistance and stem rust resistance. Protein ideotyp of winter wheat was determined for the given varieties and new breeds collection according to the frequency of protein signal genes.

winter wheat; electrophoresis; gliadins; glutenin subunites with high molecular weight; genetic structure; genetic markers; baking quality; frost resistance; protein ideotype

## INTRODUCTION

Etalon electrophoreogrammes of gliadins and glutenin subunites with HMW in single registered varieties enable fast and objective identification of wheat varieties in a seed sample. The method of signal gliadin and glutenin genes can be generally exploited in the whole wheat vertical, beginning with the selection of parental forms for crossing and ending with the control of commercial lots of food and fodder wheat quality.

Electrophoretic characteristics of gliadins and glutenin subunites with HMW of winter wheat varieties and new breeds, tested in FRA, enable more rational utilization of these varieties and new breeds in breeding, varietal testing, legislative variety protection, seed control, trade and wheat processing.

## MATERIAL AND METHODS

Bulk seed samples of 72 tested varieties and new breeds of winter wheat (*Triticum aestivum* L.) were supplied by Bundesanstalt für Pflanzenbau, Vienna (Austria).

Up to 30 grains were randomly sampled from bulk samples, and as a rule, 15 of them were used for electrophoretic analysis of gliadins and 5 for determination of electrophoretic composition of glutenin subunites with HMW. The grains were individually analyzed.

The analyzed varieties are given in table outline (Tab. I). Gliadins were analyzed by vertical column starch electrophoresis (SGE) (Šašek, Sýkorová, 1989) and glutenin subunites with HMW were separated by polyacrylamide gel electrophoresis in the presence of SDS (SDS PAGE) according to Laemmli (1960).

Allelic gliadin and glutenin blocks of electrophoretic spectra zones were examined according to the catalogues of allelic gliadin blocks (Sobko, Poperelja, 1986) and allelic glutenin blocks (Payne et al., 1981). Point values of baking quality prediction of single gliadin and glutenin allelic blocks – markers of baking quality, were determined according to Černý et al. (1985), Payne et al. (1987), Lukow et al. (1989) and Hammer et al. (1992).

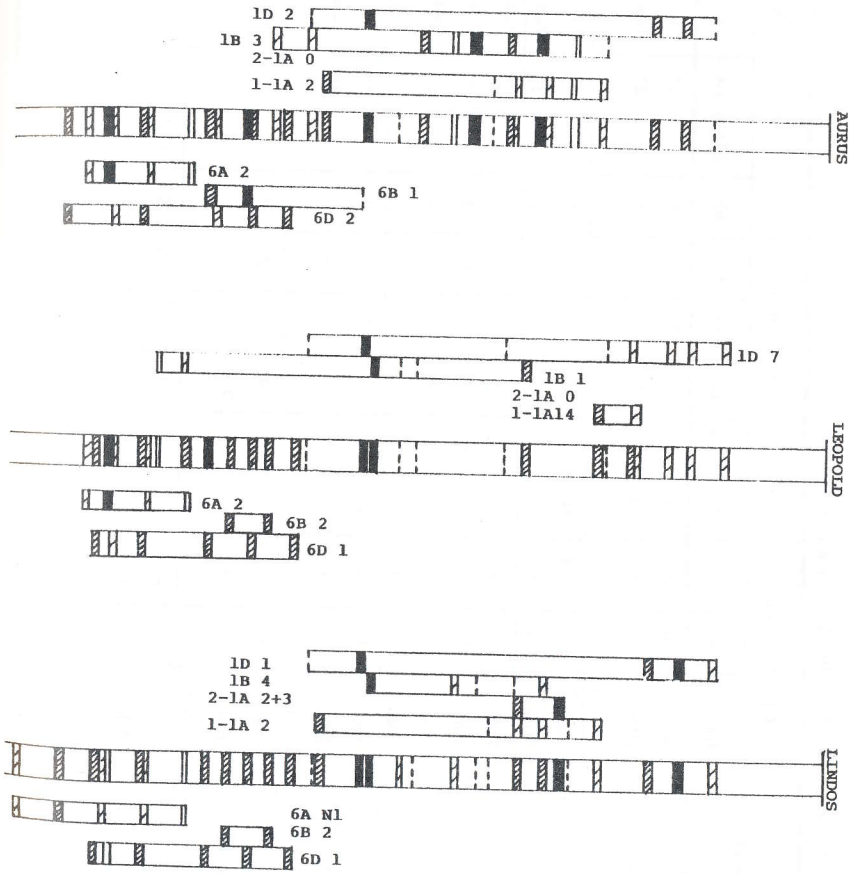
The sedimentation values were taken from the report issued by Bundesanstalt für Pflanzenbau (1993).

All the new breeds were analyzed anonymously.



## RESULTS AND DISCUSSION

Obtained electrophoretic spectra of gliadins and of the tested varieties are given in Figs. 1 and 2 by means of sketched schemes. The intensity of electrophoretic zones coloration is represented by the scale: full covering, dense hatching, rare hatching, no covering, lining, which corresponds to the values: 5 > 4 > 3 > 2 > 1 in the numerical expression (Figs. 1 and 2). According to the low polymorphism in the composition of HMW glutenins




1. Electrophoretic spectrum (electrophoreogram) of gliadins of the AURUS, LEOPOLD and LINDOS varieties, including identified allelic blocks of zones

I. Sets of GLD and GLU allelic blocks of analysed varieties

| N. | Variety | GLD/GLU lines | | | GLD locus | | | | | | | GLU locus | | | Sum of prediction points | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | line | *n* | % | 1-1A | 2-1A | 1B | 1D | 6A | 6B | 6D | 1A | 1B | 1D | GLD | GLU | GLD + + GLU |
| 1 | AGRON | Aa | 16 | 89 | 4 | 1 | 1 | 3 | (1) | 1 | 1 | 2* | 7+9 | 5+10 | 17 | 7 | 24 |
| | | (B)a | 1 | 5.55 | 9 | 0 | 1 | 3 | (1) | 1 | 2 | 2* | 7+9 | 5+10 | 17.5 | 7 | 24.5 |
| | | Admix. | 1 | 5.5 | | | | | | | | | | | | | |
| 2 | CAPO | Aa | 17 | 94.4 | 14 | 0 | 4 | 1 | 2 | 1 | 1 | 1 | 7+9 | 5+10 | 15.5 | 7 | 22.5 |
| | | (B)a | 1 | 5.55 | 14 | 0 | 4 | 1 | 2 | 2 | 1 | 1 | 7+9 | 5+10 | 17.5 | 7 | 24.5 |
| 3 | LIVIUS | Aa | 10 | 43.7 | 9 | 0 | 1 | 1 | N1 | 1 | 2 | 0 | 7+9 | 5+10 | 20.5 | 5 | 25.5 |
| | | Ba | 11 | 46 | 9 | 0 | 1 | 1 | N(1) | 1 | 2 | 0 | 7+9 | 5+10 | 20.5 | 5 | 25.5 |
| | | (C)a | 1 | 4.2 | 9 | 0 | 1 | 1 | N(1) | 1 | 1 | 0 | 7+9 | 5+10 | 19 | 5 | 24 |
| | | Admix. | 2 | 8.33 | | | | | | | | | | | | | |
| 4 | EXPERT | Aa | 14 | 78 | 14 | 0 | 4 | 3 | 2 | 1 | 1 | 0 | 7+9 | 5+10 | 14.5 | 5 | 19.5 |
| | | Ba | 2 | 11 | 14 | 3 | 4 | 3 | 2 | 1 | 1 | 0 | 7+9 | 5+10 | 14.5 | 5 | 19.5 |
| | | Admix. | 2 | 11 | | | | | | | | | | | | | |
| 5 | MARTIN | Aa | 13 | 72 | 2 | 0 | 4 | 1 | 2 | 1 | 2 | 0 | 7+9 | 5+10 | 17.5 | 5 | 22.5 |
| | | Heter. | 2 | 11 | | | | | | | | | | | | | |
| | | Admix. | 3 | 16.7 | | | | | | | | | | | | | |
| 6 | PERLO | Aa | 16 | 89 | 4 | 0 | 4 | (1) | (1) | 1 | (1) | 2* | 7+9 | 5+10 | 15.5 | 7 | 22.5 |
| | | Admix. | 1 | 11 | | | | | | | | | | | | | |
| 7 | NB 1 | Aa | 15 | 83 | 14 | 1 | 1 | (1) | 2 | 1 | 1 | 1 | 7+9 | 5+10 | 18 | 7 | 15 |
| | | Heter. | 2 | 11 | | | | | | | | | | | | | |
| | | Admix. | 1 | 5.5 | | | | | | | | | | | | | |



*Continuation of Tab. I*

| N. | Variety | GLD/GLU lines | | | GLD locus | | | | | | | GLU locus | | | Sum of prediction points | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | line | *n* | % | 1-1A | 2-1A | 1B | 1D | 6A | 6B | 6D | 1A | 1B | 1D | GLD | GLU | GLD + + GLU |
| 8 | GEORG | Aa | 10 | 40 | 14 | 0 | 4 | 2 | 2 | 1 | 1 | 1 | 7+9 | 5+10 | 14.5 | 7 | 21.5 |
| | | Ba | 2 | 8 | 14 | 2 | 4 | 2 | 2 | 1 | 1 | 1 | 7+9 | 5+10 | 14.5 | 7 | 21.5 |
| | | Ca | 2 | 8 | 9 | 0 | 4 | 2 | 2 | 1 | 1 | 1 | 7+9 | 5+10 | 14.5 | 7 | 21.5 |
| | | Da | 4 | 16 | 9 | 2 | 4 | 2 | 2 | 1 | 1 | 1 | 7+9 | 5+10 | 14.5 | 7 | 21.5 |
| | | Ea | 1 | 4 | 9 | 0 | 4 | 9 | 2 | 1 | 1 | 1 | 7+9 | 5+10 | 15 | 7 | 22 |
| | | Fa | 1 | 4 | 9 | 0 | 4 | 5 | 2 | 1 | 1 | 1 | 7+9 | 5+10 | 16 | 7 | 23 |
| | | Ga | 2 | 8 | 4 | 0 | 4 | 2 | N1 | 2 | (1) | 1 | 7+9 | 5+10 | 18.5 | 7 | 25.5 |
| | | Ha | 1 | 4 | 4 | 3 | 4 | 2 | N1 | 2 | (1) | 1 | 7+9 | 5+10 | 18.5 | 7 | 25.5 |
| | | Ia | 1 | 4 | 14 | 2 | 4 | 9 | 2 | 2 | 1 | 1 | 7+9 | 5+10 | 17 | 7 | 24 |
| | | Heter. | 1 | 4 | | | | | | | | | | | | | |
| 9 | AMADEUS | Aa | 15 | 62.5 | 4 | 0 | 3 | 8 | 2 | 2 | 1 | 2* | 7+9 | 5+10 | 11.5 | 7 | 18.5 |
| | | Ba | 9 | 37.5 | 4 | 0 | 4 | 8 | 2 | 2 | 1 | 2* | 7+9 | 5+10 | 17 | 7 | 24 |
| 10 | NB 2 | Aa | 12 | 100 | 12 | 3 | 4 | 9 | N1 | 2 | N(1) | 1 | 7+9 | 5+10 | 17 | 7 | 24 |
| 11 | NB 3 | Aa | 16 | 89 | 4 | 0 | 4 | 9 | (1) | 2 | N(1) | 0 | 7+9 | 5+10 | 17 | 5 | 22 |
| | | Heter. | 1 | 5.5 | | | | | | | | | | | | | |
| | | Admix. | 1 | 5.5 | | | | | | | | | | | | | |
| 12 | NB 4 | Aa | 12 | 100 | 9 | 0 | 4 | 2 | 2 | 1 | 1 | 1 | 7+9 | 5+10 | 14.5 | 7 | 21.5 |
| 13 | NB 5 | Aa | 12 | 100 | 2 | 0 | 4 | (2) | 3 | 2 | 1 | 0 | 6+8 | 5+10 | 18.5 | 3 | 21.5 |
| 14 | NB 6 | Aa | 6 | 50 | 4 | 0 | 4 | 2 | 3 | 2 | 1 | 0 | 6+8 | 5+10 | 19 | 3 | 22 |
| | | Ab | 6 | 50 | 4 | 0 | 4 | 2 | 3 | 2 | 1 | 1 | 7+9 | 5+10 | 19 | 7 | 26 |

Continuation of Tab. I

| N. | Variety | GLD/GLU lines | | | GLD locus | | | | | | | GLU locus | | | Sum of prediction points | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | line | *n* | % | 1-1A | 2-1A | 1B | 1D | 6A | 6B | 6D | 1A | 1B | 1D | GLD | GLU | GLD + + GLU |
| 15 | SIXTUS | Aa | 22 | 91.7 | 1 | 0 | 1 | 3 | 2 | 1 | (1) | 0 | 7+9 | 5+10 | 14.5 | 5 | 19.5 |
| | | (B)a | 1 | 4 | 4 | 0 | 1 | 3 | 2 | 1 | (1) | 0 | 7+9 | 5+10 | 18 | 5 | 23 |
| | | Admix. | 1 | 4 | | | | | | | | | | | | | |
| 16 | LEOPOLD | Aa | 24 | 100 | 14 | 0 | 1 | 5 | 2 | 2 | (1) | 0 | 7+9 | 5+10 | 20.5 | 5 | 25.5 |
| 17 | BRUTUS | Aa | 22 | 91.7 | 4 | 0 | 4 | 9 | (1) | 1 | 1 | 2* | 7+9 | 5+10 | 15 | 7 | 22 |
| | | (B)a | 1 | 4 | 2 | 0 | 4 | 1 | (1) | 1 | 1 | 2* | 7+9 | 5+10 | 15 | 7 | 22 |
| | | Admix. | 1 | 4 | | | | | | | | | | | | | |
| 18 | PLINIUS | Aa | 21 | 87.5 | 14 | 0 | 4 | 2 | N1 | 1 | 2 | 0 | 7+9 | 5+10 | 17 | 5 | 22 |
| | | (B)a | 1 | 4.2 | 4 | 0 | 4 | 2 | N1 | 2 | 1 | 0 | 7+9 | 5+10 | 18.5 | 5 | 23.5 |
| | | Admix. | 2 | 8.33 | | | | | | | | | | | | | |
| 19 | NB 7 | Aa | 5 | 41.67 | 2 | 0 | 4 | (1) | 2 | N1 | N6 | 0 | 7+9 | 5+10 | 15 | 5 | 20 |
| | | Ab | 5 | 41.67 | 2 | 0 | 4 | (1) | 2 | N1 | N6 | 0 | 7+8 | 5+10 | 15 | 6 | 21 |
| | | (B)a | 1 | 8.33 | 2 | 0 | 4 | 1 | (1) | N1 | 1 | 0 | 7+9 | 5+10 | 14.5 | 5 | 19.5 |
| | | (B)b | 1 | 8.33 | 2 | 0 | 4 | 1 | (1) | N1 | 1 | 0 | 7+8 | 5+10 | 14.5 | 6 | 21.5 |
| 20 | NB 8 | Aa | 12 | 100 | 14 | 0 | 1 | 2 | (1) | 1 | 1 | 0 | 7+9 | 5+10 | 16 | 5 | 21 |
| 21 | NB 9 | Aa | 17 | 94.4 | 14 | (0) | 4 | 7 | 2 | N5 | N6 | 0 | 7+9 | 5+10 | 16.5 | 5 | 21.5 |
| | | (B)a | 1 | 5.6 | 14 | (0) | 4 | 1 | 2 | N5 | N6 | 0 | 7+9 | 5+10 | 16.5 | 5 | 21.5 |
| 22 | GK ABLANC | Aa | 24 | 100 | 2 | 0 | 3 | 1 | (1) | 1 | 1 | 2* | 7+9 | 5+10 | 9.5 | 7 | 16.5 |
| 23 | GK CZOEKE | Aa | 24 | 100 | 2 | 0 | 1 | 1 | (1) | 1 | 1 | 0 | 7+9 | 5+10 | 17.5 | 5 | 22.5 |



*Continuation of Tab. I*

| N. | Variety | GLD/GLU lines | | | GLD locus | | | | | | | GLU locus | | | Sum of prediction points | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | line | *n* | % | 1-1A | 2-1A | 1B | 1D | 6A | 6B | 6D | 1A | 1B | 1D | GLD | GLU | GLD + + GLU |
| 24 | NB 10 | Aa | 12 | 100 | 4 | 0 | 4 | (7) | 1 | 1 | 1 | 0 | 7+8 | 5+10 | 15.5 | 6 | 21.5 |
| 25 | NB 11 | Aa | 13 | 62 | 4 | 0 | 1 | (2) | 2 | 1 | 1 | 0 | 7+8 | 5+10 | 18 | 6 | 24 |
| | | Ba | 8 | 38 | 2 | 0 | 1 | 2 | 2 | 1 | 1 | 0 | 7+8 | 5+10 | 17.5 | 6 | 23.5 |
| 26 | NB 12 | Aa | 17 | 94.5 | 14 | 0 | 1 | 7 | 2 | 2 | 1 | 0 | 7+8 | 5+10 | 20 | 5 | 25 |
| | | Admix. | 1 | 5.5 | | | | | | | | | | | | | |
| 27 | NB 13 | Aa | 12 | 57 | 2 | 0 | 4 | 6 | 2 | 2 | 2 | 0 | 7+9 | 5+10 | 19 | 5 | 24 |
| | | Ba | 9 | 43 | 2 | 0 | 4 | 2 | 2 | 2 | 2 | 0 | 7+9 | 5+10 | 18.5 | 5 | 23.5 |
| 28 | NB 14 | Aa | 15 | 83.2 | 2 | 0 | 1 | (2) | (1) | 1 | 1 | 0 | 7+9 | 5+10 | 16.5 | 5 | 21.5 |
| | | (B)a | 2 | 11.2 | 2 | 0 | 1 | (2) | (1) | 1 | 2 | 0 | 7+9 | 5+10 | 18 | 5 | 23 |
| | | Admix. | 1 | 5.6 | | | | | | | | | | | | | |
| 29 | NB 15 | Aa | 17 | 94.4 | 4 | 0 | 1 | (2) | 2 | 1 | 1 | 0 | 7+9 | 5+10 | 18 | 6 | 24 |
| | | (B)a | 1 | 5.6 | 2 | 0 | 1 | (2) | 2 | 1 | 1 | 0 | 7+8 | 5+10 | 17.5 | 6 | 23.5 |
| 30 | NB 16 | Aa | 4 | 22.2 | 2 | 0 | 4 | 1 | 2 | 2 | 2 | 1 | 7+9 | 2+12 | 19.5 | 5 | 24.5 |
| | | Ab | 4 | 22.2 | 2 | 0 | 4 | 1 | 2 | 2 | 2 | 1 | 7+8 | 2+12 | 19.5 | 6 | 25.5 |
| | | Ba | 3 | 16.7 | 9 | 0 | 4 | 1 | 2 | 1 | 2 | 1 | 7+9 | 2+12 | 17 | 5 | 22 |
| | | Bb | 3 | 16.7 | 9 | 0 | 4 | 1 | 2 | 1 | 2 | 1 | 7+8 | 2+12 | 17 | 6 | 23 |
| | | (C)a | 1 | 5.6 | 2 | 0 | 4 | 1 | N1 | 2 | 2 | 1 | 7+9 | 2+12 | 20.5 | 5 | 25.5 |
| | | Heter. | 3 | 16.6 | | | | | | | | | | | | | |
| 31 | NB 17 | Aa | 16 | 94 | 2 | 0 | 1 | (2) | (1) | 1 | 1 | 0 | 7+9 | 5+10 | 16.5 | 5 | 21.5 |
| | | Admix. | 1 | 6 | | | | | | | | | | | | | |

Continuation of Tab. I

| N. | Variety | GLD/GLU lines | | | GLD locus | | | | | | | GLU locus | | | Sum of prediction points | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | line | *n* | % | 1-1A | 2-1A | 1B | 1D | 6A | 6B | 6D | 1A | 1B | 1D | GLD | GLU | GLD + + GLU |
| 32 | NB 18 | Aa | 11 | 62.2 | 2 | 0 | 4 | 1 | N1 | 1 | 2 | 0 | 7+9 | 5+10 | 18.5 | 5 | 23.5 |
| | | Ba | 6 | 33.2 | 2 | 0 | 4 | 8 | N1 | 1 | 1 | 0 | 7+9 | 5+10 | 15.5 | 5 | 20.5 |
| | | (C)a | 1 | 5.6 | 2 | 0 | 4 | 1 | N1 | 1 | 1 | 0 | 7+9 | 5+10 | 17 | 5 | 22 |
| 33 | HUBERTUS | Aa | 13 | 72 | 9 | 0 | 4 | 9 | 2 | N1 | 1 | 1 | 6+8 | 5+10 | 14.5 | 5 | 19.5 |
| | | Ba | 5 | 28 | 9 | 0 | 4 | 9 | 2 | 2 | 1 | 1 | 6+8 | 5+10 | 17 | 5 | 22 |
| 34 | HERZOG | Aa | 17 | 94.4 | 2 | 0 | 3 | 1 | N1 | 2 | (2) | 0 | 7+9 | 2+12 | 15 | 3 | 18 |
| | | Admix. | 1 | 5.6 | | | | | | | | | | | | | |
| 35 | CLAUDIUS | Aa | 11 | 42.3 | 9 | 0 | 4 | 1 | 2 | 1 | (2) | 1 | 6+8 | 5+10 | 17 | 5 | 22 |
| | | Ab | 11 | 42.3 | 9 | 0 | 4 | 1 | 2 | 1 | (2) | 1 | 7+8 | 2+12 | 17 | 6 | 23 |
| | | Ba | 1 | 3.85 | 9 | 0 | 4 | 1 | 2 | N1 | 1 | 1 | 6+8 | 5+10 | 15 | 5 | 20 |
| | | Bb | 1 | 3.85 | 9 | 0 | 4 | 1 | 2 | N1 | 1 | 1 | 7+8 | 2+12 | 15 | 6 | 21 |
| | | Heter. | 1 | 3.85 | | | | | | | | | | | | | |
| 36 | IKARUS | Aa | 12 | 100 | 9 | 0 | 3 | 1 | 3 | 2 | (1) | 0 | 6+8 | 5+10 | 13.5 | 3 | 16.5 |
| 37 | HAI | Aa | 6 | 50 | 2 | 0 | 4 | 1 | 2 | N1 | 2 | 0 | 6+8 | 2+12 | 17 | 1 | 18 |
| | | Ab | 6 | 50 | 2 | 0 | 4 | 1 | 2 | N1 | 2 | (1) | 6+8 | 5+10 | 17 | 5 | 22 |
| 38 | ADAM | Aa | 17 | 94.4 | 4 | 0 | 4 | (4) | 2 | 1 | 1 | 0 | 7+9 | 5+10 | 17.5 | 5 | 22.5 |
| | | Ba | 17 | 94.4 | 4 | (3) | 4 | (4) | 2 | 1 | 1 | 0 | 7+9 | 5+10 | 17.5 | 5 | 22.5 |
| 39 | RENAN | Aa | 12 | 100 | 3 | 3 | 1 | 5 | 2 | 1 | 2 | 2* | 7+8 | 5+10 | 19 | 8 | 27 |
| 40 | KONSUL | Aa | 12 | 100 | (10) | 0 | 4 | 1 | 2 | N1 | 2 | 0 | 6+8 | 2+12 | 15.5 | 1 | 16.5 |
| 41 | APOLLO | Aa | 12 | 100 | 2 | 0 | 3 | 1 | N1 | N1 | 2 | 0 | 6+8 | 2+12 | 12.5 | 1 | 13.5 |





*Continuation of Tab. I*

| N. | Variety | GLD/GLU lines | | | GLD locus | | | | | | | GLU locus | | | Sum of prediction points | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | line | *n* | % | 1-1A | 2-1A | 1B | 1D | 6A | 6B | 6D | 1A | 1B | 1D | GLD | GLU | GLD + + GLU |
| 42 | NB 19 | Aa | 12 | 100 | 2 | 0 | 1 | 8 | 2 | N1 | 1 | 1 | 7+9 | 5+10 | 16.5 | 7 | 23.5 |
| 43 | NB 20 | Aa | 12 | 100 | 9 | 0 | 4 | 1 | 2 | 1 | 1 | 0 | 7 | 5+10 | 15.5 | 4 | 19.5 |
| 44 | KONTRAST | Aa | 12 | 100 | 0 | 2 | 5 | 1 | N2 | 1 | 1 | 0 | 17+18 | 5+10 | 13 | 5 | 18 |
| 45 | LINDOS | Aa | 20 | 83.3 | 2 | 2 | 4 | 1 | N1 | 2 | 1 | 0 | 7+9 | 5+10 | 19 | 5 | 24 |
| | | Heter. | 3 | 12.5 | | | | | | | | | | | | | |
| | | Admix. | 1 | 4.2 | | | | | | | | | | | | | |
| 46 | DOMINUS | Aa | 23 | 95.8 | 2 | 0 | 4 | 1 | N1 | 1 | N7 | 2* | 7 | 3+12 | 18 | 5 | 23 |
| | | (B)a | 1 | 4.2 | 4 | 0 | 4 | 1 | N1 | 1 | 1 | 2* | 7 | 3+12 | 17.5 | 5 | 22.5 |
| 47 | NB 21 | Aa | 16 | 94.1 | 2 | 2 | 4 | 1 | 2 | 2 | 2 | 1 | 7+8 | 2+12 | 19.5 | 6 | 25.5 |
| | | (B)a | 1 | 5.9 | 2 | 2 | 4 | 1 | 2 | 1 | 1 | 1 | 7+8 | 2+12 | 16 | 6 | 22 |
| 48 | JUSTUS | Aa | 24 | 100 | 2 | 2 | 4 | 1 | 2 | 1 | N7 | 0 | 6+8 | 2+12 | 17 | 1 | 18 |
| 49 | CONTRA | Aa | 12 | 100 | 4 | 0 | 4 | 1 | 3 | 1 | 1 | 0 | 6+8 | 2+12 | 18 | 1 | 19 |
| 50 | BIMBO | Aa | 24 | 100 | 2 | 0 | 4 | 1 | N1 | N1 | 1 | 0 | 7+9 | 2+12 | 16.5 | 3 | 19.5 |
| 51 | NB 22 | Aa | 12 | 100 | 2 | 0 | 3 | 8 | N1 | 1 | 2 | 0 | 7+9 | 5+10 | 11.5 | 5 | 16.5 |
| 52 | NB 23 | Aa | 10 | 59 | 2 | 0 | 4 | 1 | 2 | 2 | 2 | 0 | 7+9 | 5+10 | 19.5 | 5 | 24.5 |
| | | (B)a | 1 | 5.8 | 2 | 0 | 4 | 1 | 2 | 2 | 1 | 0 | 7+9 | 5+10 | 18 | 5 | 23 |
| | | Ca | 4 | 23.6 | 9 | 0 | 4 | 1 | 2 | 2 | 2 | 0 | 7+9 | 5+10 | 19 | 5 | 24 |
| | | (D)a | 1 | 5.8 | 9 | 0 | 4 | 1 | 2 | 2 | 1 | 0 | 7+9 | 5+10 | 17.5 | 5 | 22.5 |
| | | Admix. | 1 | 5.8 | | | | | | | | | | | | | |

Continuation of Tab. I

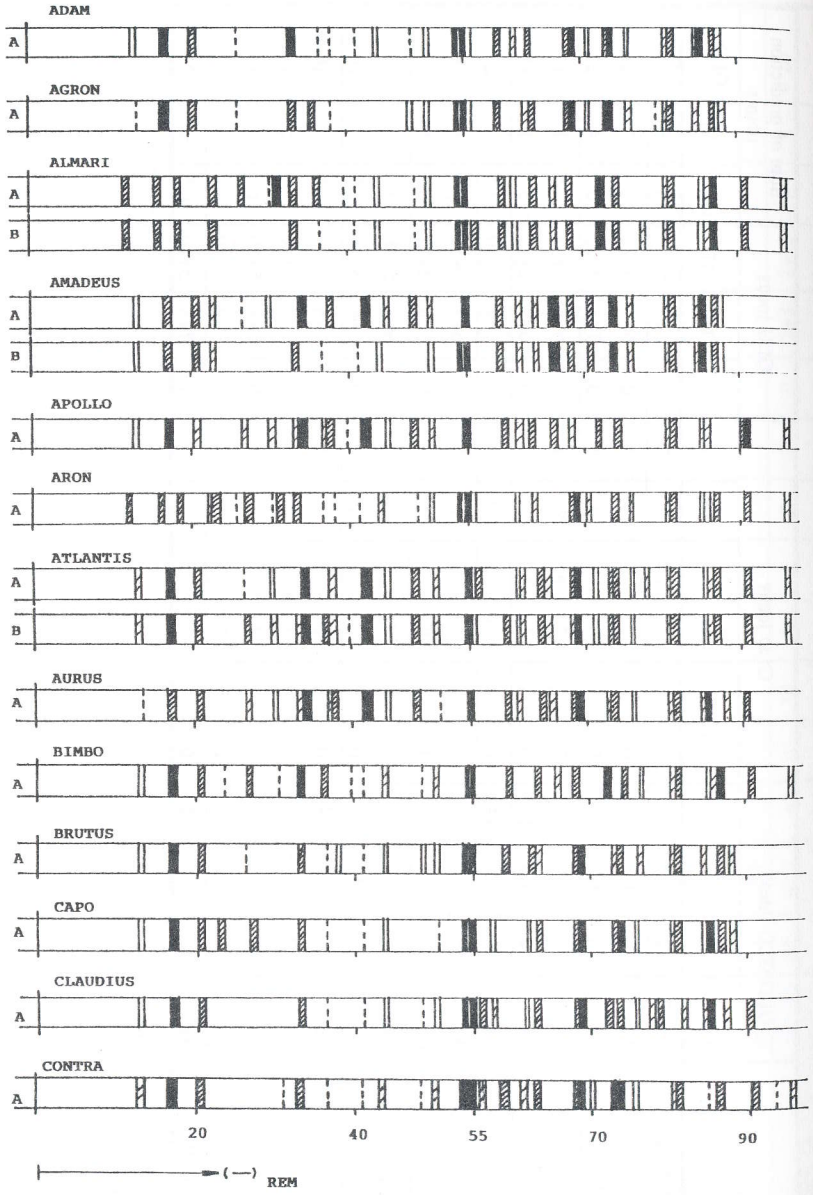
| N. | Variety | GLD/GLU lines | | | GLD locus | | | | | | | GLU locus | | | Sum of prediction points | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | line | *n* | % | 1-1A | 2-1A | 1B | 1D | 6A | 6B | 6D | 1A | 1B | 1D | GLD | GLU | GLD + + GLU |
| 53 | AURUS | Aa | 24 | 100 | 2 | 0 | 3 | 1 | 2 | 1 | 2 | (1) | 6+8 | 2+12 | 12 | 3 | 15 |
| 54 | ATLANTIS | Aa | 17 | 70.8 | 9 | 0 | 3 | 1 | N1 | 1 | 1 | 0 | 6+8 | 2+12 | 11 | 1 | 12 |
| | | Ba | 6 | 25 | 2 | 0 | 3 | 1 | N1 | 1 | 1 | 0 | 6+8 | 2+12 | 11.5 | 1 | 12.5 |
| | | (C)a | 1 | 4.2 | 2 | 0 | 3 | 1 | N1 | 2 | 1 | 0 | 6+8 | 2+12 | 13.5 | 1 | 14.5 |
| 55 | WILLI | Aa | 14 | 58.3 | 2 | 0 | 4 | 1 | (1) | 1 | 1 | 0 | 6+8 | 5+10 | 15 | 3 | 18 |
| | | Ba | 6 | 25 | 3 | 0 | 4 | 1 | (1) | 1 | 1 | 0 | 6+8 | 5+10 | 13.5 | 3 | 16.5 |
| | | (C)a | 4 | 16.7 | 9 | 0 | (1) | 1 | 3 | 1 | 1 | 0 | 6+8 | 5+10 | 19.5 | 3 | 22.5 |
| 56 | NB 24 | Aa | 12 | 100 | 10 | 0 | 3 | 2 | 2 | 1 | 1 | 0 | 7+9 | 2+12 | 8 | 3 | 11 |
| 57 | SZABOKS-1 | Aa | 12 | 100 | 12 | 0 | 1 | 1 | 2 | N1 | 1 | 0 | 6+8 | 5+10 | 16.5 | 3 | 19.5 |
| 58 | ARON | Aa | 11 | 91.7 | 14 | 2 | 4 | 5 | 3 | 1 | 1 | 0 | 7+9 | 5+10 | 17.5 | 5 | 22.5 |
| | | (B)a | 1 | 8.3 | 14 | 2 | 4 | 5 | 3 | 1 | 8 | 0 | 7+9 | 5+10 | 17 | 5 | 22 |
| 59 | NB 25 | Aa | 12 | 100 | 2 | 0 | 3 | 2 | 3 | 2 | 2 | 0 | 6+8 | 2+12 | 14.5 | 1 | 15.5 |
| 60 | XANTHOS | Aa | 12 | 100 | 4 | 0 | 4 | 1 | 2 | N8 | (1) | 1 | 6+8 | 5+10 | 18 | 5 | 23 |
| 61 | NB 26 | Aa | 12 | 100 | 2 | 0 | 3 | 1 | N1 | N1 | 2 | 0 | 7+9 | 2+12 | 12.5 | 3 | 15.5 |
| 62 | NB 27 | Aa | 12 | 100 | 9 | 0 | 3 | 1 | 3 | 1 | 1 | 0 | 6+8 | 2+12 | 11.5 | 1 | 12.5 |
| 63 | NB 28 | Aa | 6 | 46.15 | 2 | 0 | 4 | 1 | 3 | 2 | 1 | 0 | 6+8 | 2+12 | 19.5 | 1 | 20.5 |
| | | Ab | 6 | 46.15 | 2 | 0 | 4 | 1 | 3 | 2 | 1 | 1 | 6+8 | 5+10 | 19.5 | 5 | 24.5 |
| | | Heter. | 1 | 7.7 | | | | | | | | | | | | | |
| 64 | NB 29 | Aa | 11 | 91.7 | 4 | 1 | 10 | 9 | 2 | 2 | 2 | 0 | 6+8 | 2+12 | 19 | 1 | 20 |
| | | Heter. | 1 | 8.3 | | | | | | | | | | | | | |



Continuation of Tab. I

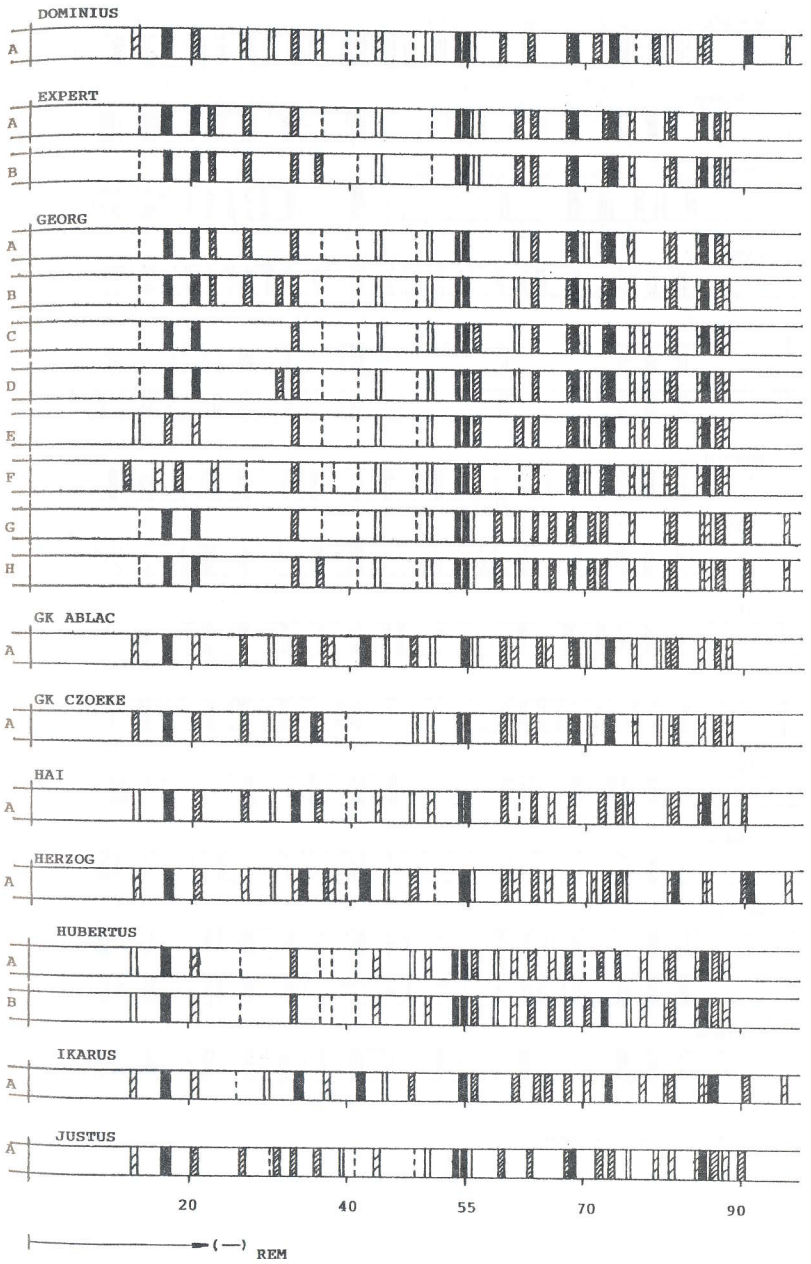
| N. | Variety | GLD/GLU lines | | | GLD locus | | | | | | | GLU locus | | | Sum of prediction points | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | line | *n* | % | 1-1A | 2-1A | 1B | 1D | 6A | 6B | 6D | 1A | 1B | 1D | GLD | GLU | GLD + + GLU |
| 65 | NB 30 | Aa | 12 | 100 | 5 | 0 | 4 | 1 | N1 | 1 | 2 | 1 | 7+8 | 5+10 | 18 | 8 | 26 |
| 66 | NB 31 | Aa | 6 | 50 | 2 | 0 | 4 | 1 | 2 | 2 | 1 | 0 | 6+8 | 5+10 | 18 | 3 | 21 |
| | | Ab | 6 | 50 | 2 | 0 | 4 | 1 | 2 | 2 | 1 | 0 | 7+8 | 2+12 | 18 | 4 | 22 |
| 67 | ALMARI | Aa | 22 | 91.7 | 2 | 2 | 4 | 7 | N1 | N1 | 1 | 0 | 6+8 | 2+12 | 16.5 | 1 | 17.5 |
| | | Ba | 2 | 8.3 | 10 | 0 | 4 | 7 | N1 | N1 | 1 | 0 | 6+8 | 2+12 | 15 | 1 | 16 |
| 68 | NB 32 | Aa | 12 | 100 | 14 | 0 | 1 | (7) | 2 | N1 | N1 | 0 | 7+9 | 5+10 | 17.5 | 5 | 22.5 |
| 69 | NB 33 | Aa | 15 | 88.2 | 5 | 0 | 1 | 2 | 2 | 1 | 1 | 0 | 6+8 | 2+12 | 17 | 1 | 18 |
| | | Ba | 2 | 11.8 | 4 | 1 | 1 | 9 | 2 | 1 | 1 | 0 | 6+8 | 2+12 | 18.5 | 1 | 19.5 |
| 70 | NB 34 | Aa | 9 | 50 | 9 | 1 | 1 | 2 | 2 | 1 | 1 | 0. | 6+8 | 5+10 | 17 | 3 | 20 |
| | | Ba | 9 | 50 | 2 | 0 | 1 | 2 | 2 | 1 | 1 | 0 | 6+8 | 5+10 | 17.5 | 3 | 20.5 |
| 71 | NB 35 | Aa | 7 | 43.75 | 9 | 0 | 4 | 2 | 1 | 1 | 1 | 0 | 6+8 | 5+10 | 13.5 | 3 | 16.5 |
| | | Ab | 7 | 43.75 | 9 | 0 | 4 | 2 | 1 | 1 | 1 | 0 | 7+9 | 5+10 | 13.5 | 5 | 18.5 |
| | | Ba | 1 | 6.25 | 9 | 0 | 4 | 2 | 3 | 1 | 1 | 0 | 6+8 | 5+10 | 16 | 3 | 19 |
| | | Bb | 1 | 6.25 | 9 | 0 | 4 | 2 | 3 | 1 | 1 | 0 | 7+9 | 5+10 | 16 | 5 | 21 |
| 72 | NB 36 | Aa | 12 | 100 | 2 | 0 | 4 | 2 | 3 | 1 | 1 | 1 | 7+8 | 5+10 | 16.5 | 8 | 24.5 |

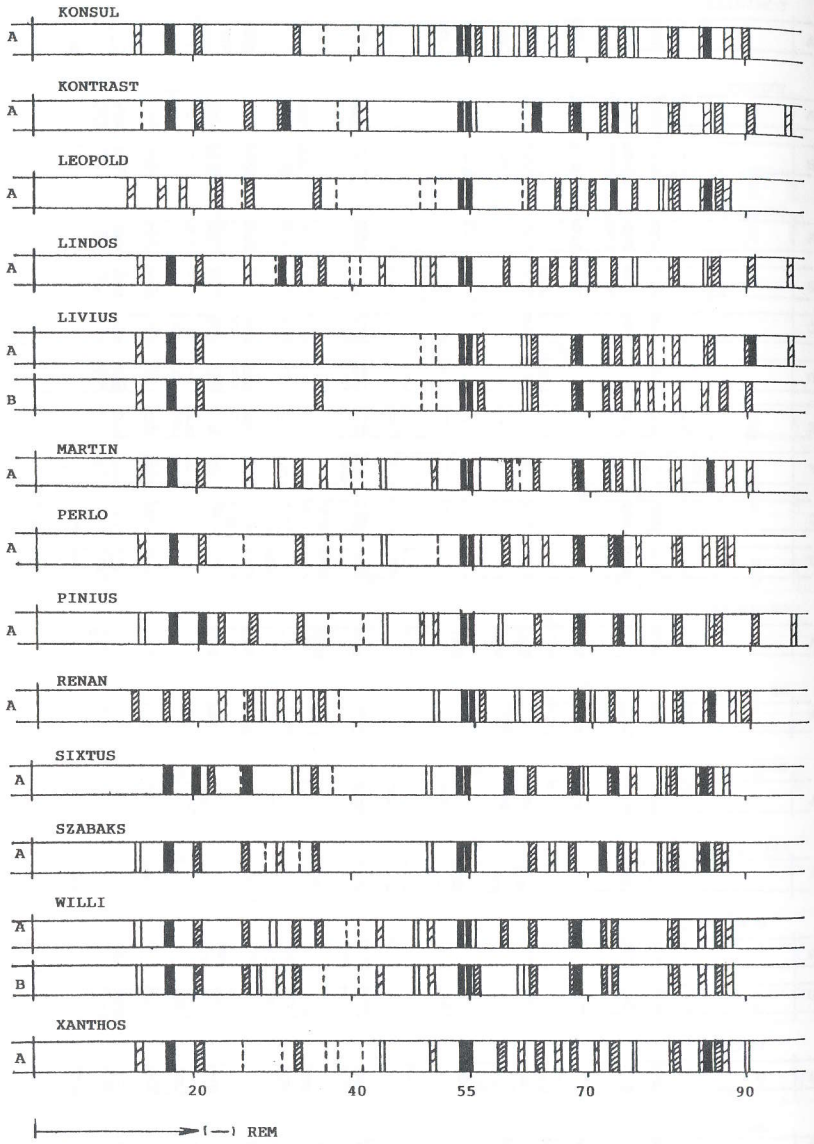
A, B, C, D, F, G, H, I – lines of GLD
a, b – lines of GLU




2. Electrophoretic spectra (electrophoreograms) of gliadin of the analysed varieties










the electrophoretic spectra of these glutenins are demonstrated in table outline only.

Individual allelic gliadin and glutenin blocks of zones (Tab. II) were excluded from the obtained electrophoretic spectra for the genetic interpretation.

**Genetic homogeneity and relationships in gliadin and glutenin blocks**

The characteristics of individual gliadin and glutenin blocks characterizing single varieties are in Tab. I.

The results show an average homogeneity of the tested set of varieties in the electrophoretic composition of gliadins and glutenin subunites with HMW. Heterogeneity in the gliadin composition was ascertained at 13,88 % of entries. The varieties AMADEUS, HUBERTUS, WILLI and new breeds NB 13, NB 33, NB 11, NB 34 are composed of 2 gliadin main lines with the same frequency.

Some varieties (ARGON, ARON, ALMARI, BRUTUS, CAPO, CLAUDIUS, DOMINUS, EXPERT, PLINIUS, SIXTUS) and new breeds (NB 7, NB 9, NB 35, NB 21, NB 15, NB 14) consist of a main gliadin line A and an adjoined line B. The varieties ATLANTIS, LIVIUS and new breeds NB 16 and NB 18 consist of 2 main gliadin lines A and B and an adjoined line C.

The maximum of heterogeneity in the gliadin composition demonstrated the variety GEORG, composed of 9 sister lines and the new breed NB 23, composed of 2 main gliadin lines and of 2 adjoined gliadin lines.

Two gliadin lines of the variety ADAM differ only in the locus 2 – 1A.

The rest of the tested varieties and new breeds represent genotypes homogenous in the composition of gliadins.

According to the codomination of the gliadin alleles ten varieties show heterozygous state in one or more gliadin loci (varieties ALMARI, CLAUDIUS, GEORG, LINDOS, MARTIN, new breeds NB 3, NB 28, NB 29, NB 1, NB 16), what represents 13.88% of the checked entries. The composition of glutenin subunites with HMW includes the varieties CLAUDIUS, HAI, and the new breeds NB 28, NB 6, NB 31, NB 35, NB 7, and NB 16 composed of two glutenin lines. Thus, the frequency of glutenin heterogenous entries reaches 11.11%.

The variety CLAUDIUS and the new breed NB 35 are simultaneously heterogenous in composition of both protein markers i.e. of the gliadins and of the glutenins with HMW.

The homogeneity of the evaluated varieties in the gliadins and glutenin composition markers the genetic structure of the predominant part of the evaluated varieties as pure lines.

II. Characteristics of allelic GLD and GLU blocks

| GLD allelic blocks | | |
|---|---|---|
| Locus | Allele | Zones, REM of the zone, coloration intensity of the zone() |
| 1-1A | 2 | 27.0(3)-30.0(1)-33.0(3)-36.5(3)-39.5(1)-60.5(3) |
| | 3 | 27.0(3)-28.5(1)-31.5(2)-57.0(4) |
| | 4 | 59.5(4)-76.0(1) |
| | 5 | 55.5(2)-58.0(2) |
| | 9 | 57.0(4)-77.5(3) |
| | 10 | 56.5(4) |
| | 12 | 27.0(3)-28.5(1)-31.5(2)-59.5(4) |
| | 14 | 23.0(4)-27.5(4) |
| 2-1A | 0 | – |
| | 1 | 33.0(4) |
| | 2 | 31.5(4) |
| | 3 | 36.0(4) |
| 1B | 1 | 36.0(4)-54.0(5)-76.5(2)-79.5(1) |
| | 3 | 30.5(1)-34.5(5)-37.5(3)-42.0(5)-45.0(1)-48.5(3)-62.5(3)-66.0(3) |
| | 4 | 33.5(3)-44.0(2)-54.0(5)-76.0(1) |
| | 5 | 27.5(3)-32.0(3)-42.0(3)-54.0(5) |
| 1D | 1 | 13.5(2)-17.5(4)-21.0(3)-55.0(5)-61.5(2) |
| | 2 | 17.5(4)-21.0(4)-55.0(5)-61.5(2) |
| | 3 | 17.5(5)-21.0(4)-26.5(1)-38.0(1)-55.0(5)-61.5(3) |
| | 4 | 12.5(3)-16.5(3)-19.0(3)-23.5(5)-55.0(5)-61.5(2) |
| | 5 | 12.5(3)-16.5(3)-19.0(3)-23.5(3)-26.5(1)-38.0(1)-55.0(5)-61.5(2) |
| | 6 | 17.5(4)-21.0(4)-23.0(3)-55.0(5)-61.5(2) |
| | 7 | 12.5(3)-16.5(3)-19.0(3)-28.5(3)-55.0(5)-61.5(2) |
| | 8 | 13.5(2)-17.5(4)-21.0(3)-23.0(3)-55.0(5)-61.5(2) |
| | 9 | 13.5(2)-17.5(4)-21.0(3)-26.5(1)-38.0(1)-55.0(5)-62.0(4) |
| 6A | 1 | 76.5(1)-81.5(2)-85.0(2)-88.5(2) |
| | 2 | 81.5(2)-85.0(5)-88.5(2) |
| | 3 | 76.5(2)-81.5(1)-87.0(3)-91.0(4)-96.0(3) |
| | N1 | 76.5(1)-86.0(3)-91.0(4)-96.0(3) |
| | N2(3) | 76.5(1)-91.0(4)-96.0(3) |



Continuation of Tab. II

| | | |
|---|---|---|
| 6B | 1 | 56.5(1)-69.0(5)-70.5(2)-73.5(3) |
| | 2 | 76.5(4)-72.0(4) |
| | N1(2) | 66.5(3)-74.5(4) |
| | N5(2) | 66.5(3)-71.0(4)-74.5(4) |
| | N8(2) | 66.5(3)-71.0(3)-90.5(2) |
| 6D | 1 | 63.5(3)-68.0(4)-74.0(4)-82.0(3)-85.0(2)-87.5(4) |
| | 2 | 63.5(3)-68.0(4)-74.0(4)-82.0(2)-85.0(2)-90.5(3) |
| | 8 | 63.5(3)-68.5(4)-74.0(4)-78.0(4)-82.0(3)-85.0(2)-87.5(4) |
| | N1 | 68.0(4)-73.5(3)-82.5(2)-84.5(2)-87.5(2) |
| | N6 | 68.5(4)-73.5(4)-82.0(3)-85.0(2)-87.0(4) |
| | N7 | 63.5(4)-68.5(4)-72.5(4)-79.5(4)-85.0(3)-90.5(2) |
| GLU allelic blocks[2] | | |
| 1A | 0 | – |
| | 1 | 75(4) |
| | 2* | 85.5(3) |
| 1B | 6+8 | 95(3)-113(3) |
| | 7 | 100(5) |
| | 7+8 | 100(5)-113(3) |
| | 7+9 | 100(5)-116(2) |
| | 13+16 | 102(4)-154(3) |
| | 14+15 | 103(4)-106(3) |
| | 17+18 | 153(4)-164(3) |
| 1D | 2+12 | 85(4)-124(4) |
| | 3+12 | 86(4)-124(4) |
| | 4+12 | 85.5(4)-124(4) |
| | 5+10 | 88(5)-120(4) |

[1] zone of references = zone 55 (55 REM, intensity 5)
[2] zone of reference = zone 7 (100 REM, intensity 5)

A relative high number of varieties and new breeds (22.22%) represents seed samples, contamined with seeds of another wheat varieties.

Only two genotypes – GEORG, line Ca and the new breed NB 4, line Aa have identical gliadin and glutenin composition. For their differentiation in a seed sample it is obviously necessary to use other genetic markers.

**Markers of baking quality**

In addition to the testing of genetic homogeneity and grades of genetic relationship obtained electrophoretic spectra provide also valuable information on markered economically important properties.

Point values of the baking quality prediction of individual gliadin and glutenin allelic blocks - markers of baking quality are given in Tab. III. The sum of set of baking quality predictions of gliadin and glutenin markers of the single evaluated varieties for baking quality are summarized in Tab. I. Maximum point value of baking quality markering show the varieties LIVIUS, LINDOS, LEOPOLD, RENAN and new breeds NB 12, NB 1, NB 30, NB 21. It is also possible to select lines with higher prediction value of marker baking quality from the varieties, such population like GEORG.

The high predictive value of marker baking quality of the variety LIVIUS is given by the occurrence of the gliadin allelic block GLD 1 B 1 – the best gliadin marker of high baking quality, simultaneously by the occurrence of the glutenin markers for higher baking quality, i.e blocks GLU 1 B 7 + 9 and GLU 1 D 5 + 10.

The high prediction value for baking quality is determined in many new breeds, mentioned above, by the occurrence of the glutenin markers for high baking quality i.e. blocks GLU 1A1, GLU 1B7 + 9 and GLU 1D5 + 10 together with the gliadin block GLD 1B4.

Minimum point values of baking quality were found out in varieties APOLLO, ATLANTIS, GK ABLANC and in new breeds NB 24, NB 27 and NB 22.

The variety ATLANTIS concentrates the markers for low baking quality i.e gliadin allelic block GLD 1B3 (secaline block) and glutenin allelic blocks GLU 1A0, GLU 1B 6 + 8 and GLU 1 D 2 + 12.

As the sources of higher baking quality those varieties can be designed, equipped with GLD 1B1, GLD 1B4, GLD 1B5, GLU 1A2, GLU 1A1, GLU 1B7 + 8, GLU 1B7 + 9, GLU 1B 17 + 18 and GLU 1D5 + 10 markers, according to the values of baking quality markers, i.e gliadin and glutenin allelic blocks. Varieties LIVIUS, LEOPOLD and new breeds NB 12 and NB 30 can be given as examples. The knowledge of genotype determination of gliadins and glutenin subunites with HMW of the varieties – sources of higher baking quality enables prediction and selection of hybrid combinations, offering a transgression in baking quality. The fact, that seven genotypes



III. Point value of GLD and GLU allelic blocks prediction – markers of baking quality

| GLD allelic blocks | | | | | | GLU allelic blocks | | |
|---|---|---|---|---|---|---|---|---|
| Locus | alleles | point value | locus | alleles | point value | locus | alleles | point value |
| 1-1A | 0 | 0 | 6A | 1 | 1 | 1A | 0 | 1 |
| | 1 | 0.5 | | 2 | 2 | | 1 | 3 |
| | 2 | 3.5 | | 3 | 3.5 | | 2* | 3 |
| | 3 | 2 | | N1 | 3 | 1B | 6+8 | 1 |
| | 4 | 4 | | N2 | 3 | | 7 | 1 |
| | 5 | 3 | 6B | 1 | 1.5 | | 7+8 | 3 |
| | 9 | 3 | | 2 | 3.5 | | 7+9 | 2 |
| | 10 | 2 | | N1 | 1 | | 13+16 | 3 |
| | 12 | 2 | | N2 | 3.5 | | 14+15 | 1 |
| | 14 | 3 | | N5 | 3 | | 17+18 | 3 |
| 2-1A | 0 | 0 | | N8 | 3 | | 20 | 1 |
| | 1 | 0 | 6D | 1 | 1.5 | 1D | 2+12 | 2 |
| | 2 | 0 | | 2 | 3 | | 3+12 | 2 |
| | | | | 8 | 1 | | 4+12 | 1 |
| | 3 | 0 | | N1 | 1.5 | | 5+10 | 4 |
| 1B | 1 | 8 | | N6 | 1.5 | | | |
| | 3 | 0 | | N7 | 3 | | | |
| | 4 | 5.5 | | | | | | |
| | 5 | 5 | | | | | | |
| | 10 | 5 | | | | | | |
| 1D | 1 | 2 | | | | | | |
| | 2 | 1 | | | | | | |
| | 3 | 1 | | | | | | |
| | 4 | 3 | | | | | | |
| | 5 | 2.5 | | | | | | |
| | 6 | 1.5 | | | | | | |
| | 7 | 2 | | | | | | |
| | 8 | 0.5 | | | | | | |
| | 9 | 1.5 | | | | | | |

* point value of baking quality prediction (8 = maximum, 0 = minimum)

(RENAN, CADO-B, LIVIUS, LEOPOLD, NB 11, NB 12, NB 15) equipped with Gld 1B1 allele – marker of the highest baking quality, shows the importance of parallel electrophoretic analysis of glutenins with HMW and gliadins.

The testing of correlation relationships between the predicted value of baking quality and the actual baking quality, represented by the sedimentation value, is important for the use of allelic gliadin and glutenin allelic blocks as markers of baking quality. Result of this correlation analysis proved that a significant positive correlation existed between gliadin markers, glutenin markers and the total marker point value of baking quality of gliadin and glutenin allelic blocks on one side and sedimentation value on the other side in the set of tested varieties, new breeds (Tab. IV). This supports the use of

IV. Correlations between point marking value of GLD and GLU allelic blocks and sedimentation value (ml)

| N | *X* | *Y* | *n* | *r* | Significance |
|---|---|---|---|---|---|
| 1 | GLD prediction points | SDT | 68 | 0.26 | * |
| 2 | GLU prediction points | SDT | 68 | 0.43 | * * |
| 3 | Sum GLD + GLU prediction points | SDT | 68 | 0.39 | * * |

Significance: * $P < 0.005$, * * $P < 0{,}001$
Notice: SDT = sedimentation value (ml) after ICC standard No 118 (Sedimentationswert)

both types of protein markers for baking quality predictions.

**Markers of frost resistance**

Furthermore, the obtained results enable markering of the frost resistance. Both main gliadin markers of higher frost resistance, i.e. alleles Gld 1D5 and Gld 6A3 were found out in the ARON variety only (Tab. I).

Genotypes GEORGE – F, LEOPOLD, RENAN, EXPERT; IKARUS, CONTRAST, WILLI – C and new breeds NB 5, NB 6, NB 25, NB 27, NB 28 and NB 35 are equipped with one of the main markers of frost resistance, i.e. GLD 1D5 or GLD 6A3.

In the electrophoretic gliadin spectrum of some varieties and new breeds modified block GLD 6 AN 1, or GLD 6AN2, belonging to the family of allelic gliadin blocks 6 A 3, is manifested. The markering of a higher frost resistance was not experimentally verified by these modified blocks.



V. Percentage of alleles in single locuses of GLD genes and single locuses of GLU genes

| GLD – locus 1-1A | | |
|---|---|---|
| Allele | frequency | (%) |
| 2 | 49 | 38.281 |
| 9 | 29 | 22.656 |
| GLD – locus 2-1A | | |
| Allele | frequency | (%) |
| 0 | 105 | 82.031 |
| 2 | 11 | 8.594 |
| GLD – locus 1B | | |
| Allele | frequency | (%) |
| 4 | 84 | 65.625 |
| 1 | 27 | 21.094 |
| GLD – locus 1D | | |
| Allele | frequency | (%) |
| 1 | 59 | 46.094 |
| 2 | 24 | 18.75 |
| GLD – locus 6A | | |
| Allele | frequency | (%) |
| 2 | 67 | 52.344 |
| N1 | 24 | 18.75 |
| GLD – locus 6B | | |
| Allele | frequency | (%) |
| 1 | 72 | 56.25 |
| 2 | 35 | 27.344 |
| GLD – locus 6D | | |
| Allele | frequency | (%) |
| 1 | 79 | 61.719 |
| 2 | 28 | 21.875 |
| GLU – locus 1A | | |
| Allele | frequency | (%) |
| 0 | 91 | 71.094 |
| 1 | 33 | 25.781 |
| GLU – locus 1B | | |
| Allele | frequency | (%) |
| 7+9 | 72 | 56.25 |
| 6+8 | 36 | 28.125 |
| GLU – locus 1D | | |
| Allele | frequency | (%) |
| 5+10 | 95 | 74.219 |
| 2+12 | 31 | 24.219 |

Adjoining gliadin markers of a medium frost resistance, i.e. allelic gliadin blocks GLD 1A1, GLD 1A2 and GLD 6D2 were found in a number of tested variety sets (see Tab. I).

For the use of gliadin markers with a higher frost resistance it is necessary to consider their unequal, but additive effects (Černý et al., 1990).

### Markering of stem rust resistance

Finally, the results obtained can be used for markering the stem rust resistance. The evaluated set of varieties consists mainly of the varieties with medium to high baking quality, markered by the gliadin allelic blocks GLD 1B1, or GLD 1B4, GLD 1B5. The presence of secalin block GLD 1B3, markering a bad baking quality and at the same time stem rust resistance were found only in the genotypes AMADEUS – A, GK ABLANC, HERZOG, IKARUS, APOLLO, NB 26, AURUS, ATLANTIS, NB 22, NB 24, NB 25, NB 26, NB 27, i.e. at 16.67% of evaluated entries (Tab. I).

### Protein ideotype

The highest frequency of individual used gliadin genes and genes of glutenins subunites with HMW is given in Tab. V.

Nowadays, alleles manifested by the maximum frequency present a protein ideotype of winter wheat – of varietal composition, tested in FRG in the state varietal tests in the year 1993.

### Acknowledgements

The authors are grateful to O. Univ. Prof. Dipl. Ing. Dr. P. Ruckenbauer, (Universität für Bodenkultur, Vienna) for his helpful suggestions and for critical comments on this paper. The authors are also grateful to Dipl. Ing. Michal Oberforster (Federal Institute for Plant Production, Vienna) for providing the seed materials and for agreeing the use of "Qualitätsuntersuchungen der Winter und Sommerweizen – Sortenversuche 1992" and Wintergetreide-Sortenversuche 1993, 1994.

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Received for publication on March 25, 1996

ČERNÝ, J. – ŠAŠEK, A. (Česká zemědělská univerzita, Agronomická fakulta, Praha; Výzkumný ústav rostlinné výroby, Praha-Ruzyně, Česká republika):

**Elektroforetická analýza gliadinů a podjednotek gluteninů s vysokou molekulovou hmotností odrůd pšenice ozimé (*T. aestivum* L.) testovaných ve státních odrůdových pokusech v Rakousku.**

Scientia Agric. Bohem., *27*, 1996 (4): 237–260.

Byla uskutečněna elektroforetická analýza gliadinů a podjednotek gluteninů s vysokou molekulovou hmotností (VHM) u 72 odrůd a nových šlechtění pšenice ozimé (*Triticum aestivum* L.), zkoušených v letech 1992 a 1993 ve státních odrůdových pokusech Spolkového úřadu pro rostlinnou výrobu ve Vídni (Rakousko). Z ramšových vzorků osiva, dodaných Spolkovým úřadem pro rostlinnou výrobu (Vídeň), bylo odebráno po 15 zrnech pro elektroforézu gliadinů a po 5 zrnech pro elektroforézu podjednotek gluteninů s VHM. Zrna byla analyzována jednotlivě.

K analýze gliadinů bylo použito vertikální elektroforézy ve sloupcích škrobového gelu (Šašek, Sýkorová, 1989), k analýze podjednotek gluteninů s VHM elektroforézy v polyamidovém gelu (SDS PAGE) podle autora Laemmli (1960).

Alelické bloky gliadinů a podjednotek gluteninů s VHM byly vyčleněny z elektroforetických spekter podle autorů Sobko, Poperelja (1986), resp. Payne et al. (1981). Bodové hodnoty predikce pekařské jakosti jednotlivých alelických bloků

gliadinů, resp. podjednotek gluteninů s VHM byly stanoveny podle autorů Černý et al. (1985), resp. Payne et al. (1987), Lukow et al. (1989) a Hammer et al. (1992).

Pomocí elektroforézy gliadinů a podjednotek gluteninů s VHM byla hodnocena genetická homogenita a specifičnost analyzovaných odrůd a nových šlechtění. Celkem 13,88 % zkoušených čísel bylo heterogenních ve skladbě gliadinů a 11,11 % heterogenních ve skladbě podjednotek gluteninů s VHM.

Orientačně byla stanovena pro jednotlivé odrůdy a nová šlechtění, resp. pro jejich bílkovinné linie bodová hodnota predikce pekařské jakosti. Mezi pekařskou jakostí a predikční bodovou hodnotou gliadinových a gluteninových alelických bloků – markerů pekařské jakosti – byla prokázána významná, resp. vysoce významná korelace.

Jednotlivé odrůdy a nová šlechtění byly hodnoceny podle výskytu gliadinových a gluteninových markerů mrazuvzdornosti a odolnosti ke rzi travní.

Podle četnosti bílkovinových signálních genů byl stanoven pro daný soubor odrůd a nových šlechtění bílkovinný ideotyp pšenice ozimé.

pšenice ozimá; elektroforéza; gliadiny; podjednotky gluteninů s vysokou molekulovou hmotností; genetická struktura; genetické markery; pekařská jakost; mrazuvzdornost; bílkovinný ideotyp

*Contact Address:*

Prof. Ing. Jiří Černý, CSc., Česká zemědělská univerzita, Agronomická fakulta, Kamýcká 129, 165 21 Praha 6-Suchdol, Česká republika, tel.: 02/24 38 25 54, fax: 02/24 38 28 01