COMMON WHEAT (*T. AESTIVUM* L.) MARKING BY DETERMINATION OF APPROXIMATE DEPENDENCE OF FREQUENCY OF ALLELIC GLIADIN GENES ON QUALITY GRADE OF AGRONOMIC CHARACTER

J. Černý[1], A. Šašek[2], P. Vejl[1], A. Hanišová[3]

[1] *Czech University of Agriculture, Faculty of Agronomy, Prague, Czech Republic*
[2] *Research Institute for Crop Production, Prague-Ruzyně, Czech Republic*
[3] *SELGEN – Breeding Station, Stupice, Czech Republic*

Association coefficients were used to evaluate an ability of different alleles of marker-gliadin genes to mark baking quality, 1 000-kernel weight, resistance to stem rust, resistance to leaf rust, resistance to yellow rust and length of the growing season. 66 domestic and foreign varieties and new breeds of winter wheat, tested at the breeding station SELGEN – Stupice in 1990 to 1992, were used as an experimental material.

common wheat; gliadin genes; marking; association coefficients; economic characters

INTRODUCTION

Marking of economically important characters and properties of common wheat by marker-prolamin genes is usually based on parallel hybridological or monosomic analysis and electrophoresis of genetic prolamin markers. The above procedure proved in common wheat an ability of gliadin marker-genes to mark frost-hardiness and resistance to stem rust and with marker-genes of HMW glutenin subunits also the baking quality (Sozinov, 1985). This parallel analysis is laborious, expensive and time-consuming.

The study was aimed at an increase of the number of agronomically important common wheat characters and properties marked by marker-gliadin genes by approximately determined dependence of rate of allelic gliadin genes on the quality grade, value of some select agronomically important common wheat characters and properties.

MATERIAL AND METHODS

A prerequisite of approximate determination of association, correlation between allelic marker-genes and the value of investigated characters is a sufficient genetic variability of an employed set of common wheat varieties and new breeds. 66 domestic and foreign common wheat varieties and new breeds were used as an experimental material. They were studied in three years' tests for performance (1990 to 1992) at the breeding station SELGEN at Stupice. The list of genotypes employed, including allelic characteristics of gliadin genes and HMW glutenin genes, is in Tab. I.

An ability of gliadin marker-genes to mark by association coefficients (correlations) the baking quality, TKW, resistance to stem rust, resistance to yellow rust, resistance to leaf rust and length of the growing season.

The method of vertical electrophoresis in starch gel – SGE (Šašek et al., 1989) was employed to manifest gliadin marker-genes. Allelic gliadin blocks were classified after Sobko, Poperelja (1986).

Electrophoretic spectra of HMW glutenins were set by the modified procedure of vertical discontinuous electrophoresis in polyacrylamide in the presence of sodium dodecylsulfate – SDS PAGE (Laemmli, 1970). Allelic glutenin blocks of zones or allelic zones of HMW glutenins were finding after Payne et al. (1981).

χ^2 test was applied to set the dependence between occurrence of different alleles of gliadin genes (Gld 1-1A, 2-1A, 1B, 1D, 6A, 6B and 6D) and studied character or its quality grade. χ^2 criterion served for assessment of the difference of actual and expected rate of common occurrence of both variables, i.e. rate of alleles and percentage of quality grades of evaluated characters.

The following formula was used for calculation:

$$\chi^2 = \Sigma i \, \Sigma j \frac{n^2 ij \, . \, n}{n_i \, . \, n_j}$$

where: i – columns of the contingence tablet
j – rows of the contingence tablet
n – total sum of the individuals of the contingence tablet
n_i – sum of individuals of the column
n_j – sum of individuals of the row

The number of degrees of freedom was set according to the formula:

$$f = (k - 1) \, (m - 1)$$

where: k – number of alternatives of one character
m – number of alternatives of the second character

I. Survey of genotypes including allelic characteristics of gliadin genes and HMW glutenin genes

Genotype	Line	Electrophoretic spectrum of approved common wheat varieties and new breeds									
		GLD							GLU		
		1-1A	2-1A	1B	1D	6A	6B	6D	1A	1B	1D
APOLLO	A	2	0	3	1	N1	2	2	0	6+8	2+12
ARES 268	A	2	1	4	8	N1	1	1	0	6+8	2+12
ARKONA	A	2	0	3	1	N1	2	2	0	6+8	2+12
BEAVER	A	4	0	3	1	N1	1	2	0	6+8	2+12
BLAVA	A	2	0	1	1	(1)	1	1	0	7+9	5+10
BR 1897	A	2	0	1	1	(1)	1	1	0	7+9	5+10
BR 1897	B	2	0	3	1	(1)	1	1	0	7+9	5+10
BR 1897	C	2	1	1	1	(1)	1	1	0	7+9	5+10
BR 614/9	A	2	0	1	9	2	(2)	2	0	7+9	5+10
BR 724	A	2	0	4	9	(1)	1	N	0	7+9	5+10
BR 724	B	2	0	1	9	(1)	1	N	0	7+9	5+10
BR 724	C	2	0	1	9	(1)	1	1	0	7+9	5+10
BRUTA	A	2	0	4	1	1	1	1	0	6+8	5+10
BU 30	A	2	0	1	1	(1)	1	1	0	7+9	5+10
BUSSARD	A	10	0	4	9	N1	1	1	1	7+9	5+10
COBRA	A	4	0	3	1	2	1	1	0	6+8	2+12
DANUBIA	A	3	3	3	2	2	1	1	1	7+9	5+10
DONAU	A	13	0	1	1	2	N	1	0	7+8	5+10
ESTICA	A	9	2	4	1	2	1	1	0	6+8	2+12
HANA	A	3	1	4	9	2	1	N1	2*	7+9	5+10
HANA	B	3	3	4	9	2	1	N1	2*	7+9	5+10
HE 3031	A	9	2	4	9	1	1	1	0	7+9	5+10
HE 3031	B	2	2	4	1	2	1	1	0	7+9	5+10
HE 3936	A	2	2+3	1	9	3	1	N	1	7+9	2+12
HE 3936	B	2	2+3	1	9	1	1	N	1	7+9	2+12
HE 3936	{C}	2	2	1	1	1	1	1	1	7+9	2+12
HE 3936	{D}	2	2	1	1	3	1	1	1	7+9	2+12
HE 4866	A	2	2	4	1	2	1	1	0	7+8	5+10
HEREWARD	A	4	0	4	1	N1	1	1	0	7+9	2+12
ILONA	A	3	(0)	1	5	(1)	1	1	0	7+9	5+10

Continuation of Tab. I

Genotype	Line	Electrophoretic spectrum of approved common wheat varieties and new breeds									
		GLD							GLU		
		1-1A	2-1A	1B	1D	6A	6B	6D	1A	1B	1D
ILONA	B	2	(0)	1	5	(1)	1	1	0	7+9	5+10
IRIS	A	4	0	3	2	(1)	1	1	0	7	2+12
KNIRPS	A	2	0	3	1	N1	N	1	0	7+8	2+12
KONTRAST	A	0	2	5	9	N1	2	1	0	17+18	5+10
KONTRAST	B	0	2	5	9	N1	2	1	0	7+8	5+10
KOŠÚTKA	A	4	3	15	3	3	1	2	0	7+9	5+10
LIVIA	A	15	0	3	2	N1	3	2	1	7+9	5+10
LIVIA	B	15	0	3	2	N1	3	2	1	7+9	2+12
LOUVRE	A	3	3	4	1	2	1	2	0	7+9	2+12
MONA	A	10	0	3	1	N1	3	2	2*	7+9	5+10
NSA 90-5318	A	4	0	4	9	2	1	2	0	17+18	2+12
RA 18	A	2	0	1	1	(1)	1	1	0	7+9	5+10
REGINA	A	9	2	4	1	1	1	1	0	7+9	5+10
RIBAND	A	2	0	4	1	3	1	1	0	6+8	2+12
RU 22	A	3	(1)	4	9	2	N	1	0	7+8	2+12
RU 22	B	3	(1)	4	9	2	N	2	0	7+8	2+12
SAMANTA	A	2	0	4	9	2	1	1	0	7+8	5+10
SELEKTA	A	2	0	3	1	1	3	1	0	6+8	2+12
SENTA	A	3	0	3	2	N2	1	1	1	7	2+12
SIDA	A	2	0	3	1	3	3	1	1	7+9	2+12
SIMONA	A	9	2+3	4	1	2	1	2	0	7	2+12
SIMONA	C	9	2	4	1	2	1	2	0	7	2+12
SIRIA	A	4	0	4	1	2	1	1	0	7+9	5+10
SO 4002	A	(5)	3	1	2	(1)	1	1	1	7+9	5+10
SO 7953	A	4	3	1	2	(1)	1	1	1	7+9	5+10
SO 928	A	2	0	1	2	(1)	1	1	0	7+9	5+10
SO 928	B	2	0	1	2	(1)	1	1	1	7+9	5+10
SOFIA	A	3	(0)	3	1	2	1	1	1	7	2+12
SOFIA	B	3	0	3	1	2	1	2	1	7	2+12
SOISSONS	A	10	0	1	9	1	2	1	0	7+8	5+10

Continuation of Tab. I

Genotype	Line	Electrophoretic spectrum of approved common wheat varieties and new breeds									
		GLD							GLU		
		1-1A	2-1A	1B	1D	6A	6B	6D	1A	1B	1D
SPARTA	A	2	0	3	(1)	2	3	2	0	6+8	5+10
ST 229	A	10+9	0+2	4	1+9	3	1	1+N1	0	7+8	5+10
ST 2431	A	2	2+3	4	1	3	1	1	0	7+8	5+10
ST 258	A	10	0	4	1	2	2	2	0	6+8	2+12
ST 352	A	2	0	4	9	1	1	N1	0	7+8	5+10
ST 587	A	4	1+3	1	9	1	1	1	0	7+9	5+10
TAW 25974	A	4	0	5	9	1	2	2	0	7+9	5+10
THESEE	A	10	0	4	1	2	N	1	0	6+8	2+12
TORONTO	A	10	0	3	1	2	1	1	0	7+9	5+10
TORYSA	A	12	0	4	1	2	1	1	0	6+8	2+12
TORYSA	B	12	0	4	1	2	1	1	0	7+8	2+12
UH 139	A	4	0	4	1	2	N	1	0	7+9	5+10
UH 2105	A	2	0	3	9	N1	(1)	1	0	7+9	2+12
UH 2105	B	2	0	3	9	1	(1)	1	0	6+8	2+12
UH 410	A	4	0	3	1	3	1	2	0	7+9	5+10
UH 410	B	4	0	3	1	2	1	1	0	7+9	5+10
UH 466	A	3	3	4	9	2	1	N1	0	6+8	5+10
UH 515	A	3	2	4	1	2	1	2	2*	7+9	5+10
UH 515	B	3	2	4	5	2	1	2	2*	7+9	5+10
UH 540	A	3	2	4	1	2	1	N1	0	6+8	5+10
UH 540	B	3	2	4	5	2	1	2	0	6+8	5+10
UH 540	C	3	2	4	1	2	1	2	0	6+8	5+10
UH 540	D	3	0	4	9	2	N	N1	0	6+8	5+10
UH 540	E	3	0	4	9	2	N	N1	0	7+8	5+10
VEGA	A	2	2	4	1	2	1	(1)	0	7+8	5+10
VIGINTA	A	2	0	1	1	(1)	1	1	0	7+9	5+10
VIKING	A	2	0	5	1	2	N	1	0	6+8	3+12
VIVANT	A	9	0	4	1	2	N	1	0	6+8	2+12
VLADA	A	14	0	1	7	2	1	2	1	7+9	5+10
ZDAR	A	3	2+3	4	1	N1	1	2	0	7	2+12

Zero hypothesis on α significance level was rejected in excess of critical tabular value.

Predicted dependence of both followed parameters (k, m) was evaluated with probability 100 – α. The tightness of dependence was expressed by association coefficient.

$$V = \sqrt{\frac{x^2}{n}}$$

RESULTS AND DISCUSSION

Marking of genetic systems conditioning agronomically important properties of qualitative and quantitative nature, using marker-genes may be influenced by direct action of marker-genes on the value of marked trait. Action of gliadin genes in HMW glutenin genes on the quality of gluten complex and hence on the baking quality can serve as an example.

Another mechanism of marking is the linkage of marker-genes on genes of economically important properties, located in the same chromosome. The linkage of marker-gene Gld 1B3, located in translocated segment R1/B1 together with the resistance gene to stem rust of grain, can serve as an example. Both these marking mechanisms by marker-genes require time-consuming and laborious hybridological analysis.

An advantageous way of finding marking effects of marker-protein genes is the use of isogenic lines differing only by allelic outfit of marker-genes and marked genes of studied agronomic properties. In principle, this is again time-consuming hybridological analysis.

The dependence between marker-genes and marker properties, traits can be finding by evaluation of polymorphism of marker-genes and polymorphism of agronomic properties, traits. The rate of alleles of marker-genes gives an indirect information about association of these alleles with grades of expression of followed agronomic properties, traits. This procedure replacing hybridological analysis was used for approximate determination of association between marker-genes and studied agronomic properties, traits.

Polymorphism of gliadin marker-genes is expressed by sets of gliadin allelic blocks of evaluated varieties (Tab. I).

Average three-year values of investigated six agronomic traits of an evaluated set of varieties are presented in Tab. II. Evaluated traits were divided into several (3 to 4) classes of expression (Tab. III).

Allele Gld 1B3 ($V = 0.63^{xx}$) shows a maximum ability to mark the baking quality according to the gained values of association coefficient what con-

II. Survey of evaluated traits

Genotype	Line	Evaluated traits					
		baking quality grade	1 000-kernel weight	earliness of earing	leaf rust	stem rust	yellow rust
		points	g	days	points	points	points
APOLLO	A	4	46.16	244	9	8	7
ARES 268	A	7.5	46.9	239	5	4	6
ARKONA	A	2	53.75	242	7	7	6
BEAVER	A	5.5	35.15	239	7	7	9
BLAVA	A	6.5	41	237	9	5	5
BR-1522	A	7	55	237	9	6	7
BR-1897	A	6.5	52.2	238	7	7	7
BR-1897	B	6.5	52.2	238	7	7	7
BR-1897	C	6.5	52.2	238	7	7	7
BR-614/9	A	7	47.1	239	7	6	8
BR-724	A	6.5	52.45	239	7	7	7
BR-724	B	6.5	52.45	239	7	7	7
BR-724	C	6.5	52.45	239	7	7	7
BU-30	A	6.5	54.25	238	9	5	8
BUSSARD	A	9	50.15	242	6	3	7
COBRA	A	3	40.95	237	6	7	6
DANUBIA	A	4	40.9	234	8	7	2
DONAU	A	7.5	48.32	239	9	4	5
ESTICA	A	3	48.3	244	9	4	9
HANA	A	9	46.8	238	5	6	8
HANA	B	9	46.8	238	5	6	8
HE-3031	A	6	40.4	241	8	5	7
HE-3031	B	6	40.4	241	8	5	7
HE-3936	A	9	44.75	236	7	6	7
HE-3936	B	9	44.75	236	7	6	7
HE-3936	C	9	44.75	236	7	6	7
HE-3936	D	9	44.75	236	7	6	7
HE-4866	A	7.5	44.5	237	8	7	7
HEREWARD	A	7.5	42.5	243	9	6	8
ILONA	A	7	43	236	6	8	6
ILONA	B	7	43	236	6	8	6

Continuation of Tab. II

Genotype	Line	Evaluated traits					
		baking quality grade	1 000-kernel weight	earliness of earing	leaf rust	stem rust	yellow rust
		points	g	days	points	points	points
IRIS	A	2	41.1	235	6	9	5
KNIRPS	A	3.5	47.05	239	6	7	5
KONTRAST	A	6	44.51	240	6	7	9
KONTRAST	B	6	44.51	240	6	7	9
KOŠÚTKA	A	7	45.9	232	6	7	8
LIVIA	A	4	48.1	236	5	8	3
LIVIA	B	4	48.1	236	5	8	3
LOUVRE	A	3	44.3	238	9	3	7
MONA	A	4	56.5	239	5	7	6
NSA 90-5318	A	4	37.04	240	8	4	8
RA-18	A	9	50	240	6	6	7
REGINA	A	7.5	44.5	242	5	4	7
RIBAND	A	6	42.15	242	9	5	8
RU-22	A	7.5	49.45	238	8	6	8
RU-22	B	7.5	49.45	238	8	6	8
SAMANTA	A	7	46.65	238	5	5	6
SELEKTA	A	2	47.27	240	4	7	7
SENTA	A	4	44.75	239	4	7	6
SIDA	A	6	49.1	240	9	7	7
SIMONA	A	4	48.75	241	9	4	8
SIMONA	C	4	48.75	241	9	4	8
SO-4002	A	7.5	49.95	237	7	6	6
SO-7953	A	5	52.35	237	6	7	8
SO-928	A	6	49.53	238	9	6	6
SO-928	B	6	49.53	238	9	6	6
SOFIA	A	4	45.25	239	5	7	7
SOFIA	B	4	45.25	239	5	7	7
SOISSONS	A	6	46.5	237	9	4	7
SPARTA	A	4	42.86	238	3	7	5
ST-229	A	7	44.88	240	6	5	7
ST-229	B	7	44.88	240	6	5	7

Continuation of Tab. II

Genotype	Line	Evaluated traits					
		baking quality grade	1 000-kernel weight	earliness of earing	leaf rust	stem rust	yellow rust
		points	g	days	points	points	points
ST-2431	A	7.5	47.3	244	6	4	9
ST-258	A	1	49.55	242	9	3	7
ST-265	A	5.5	46.3	243	9	3	7
ST-265	B	5.5	46.3	243	9	3	7
ST-352	A	5.5	44.95	236	8	7	7
ST-587	A	6	45.4	238	7	7	7
TAW 25974	A	7	45.75	242	8	3	9
THESEE	A	5	47.65	235	8	5	6
TORONTO	A	6	44.35	244	8	6	9
TORYSA	A	4.5	52.65	240	9	5	7
TORYSA	B	4.5	52.65	240	9	5	7
UH-139	A	6.5	50.1	245	9	4	8
UH-139	B	6.5	50.1	245	9	4	8
UH-139	C	6.5	50.1	245	9	4	8
UH-2105	A	4	45.8	242	8	8	9
UH-2105	B	4	45.8	242	8	8	9
UH-410	A	3	47.85	240	9	7	8
UH-410	B	3	47.85	240	9	7	8
UH-466	A	6	54.55	240	6	4	9
UH-515	A	8	54	239	7	7	9
UH-515	B	8	54	239	7	7	9
UH-540	A	7	45.7	241	9	8	8
UH-540	B	7	45.7	241	9	8	8
UH-540	C	7	45.7	241	9	8	8
VEGA	A	7	46.55	243	5	5	6
VIGINTA	A	7	48	236	6	6	6
VIKING	A	6	40.35	240	9	5	6
VIVANT Z-162	A	6	43.75	244	9	5	9
VLADA	A	9	46.8	237	8	5	9
ZDAR	A	5	47.4	243	6	4	8

III. Classification of evaluated traits

Baking quality		
Feeding wheat	in grade I	3–5 points
Food wheat (lower quality)	in grade II	5.5–6.5 points
Food wheat (excellent quality)	in grade III	7–9 points
1 000-kernel weight (TKW)		
Low	in grade I	35.15–44.99 g
Medium	in grade II	45.00–47.99 g
High	in grade III	48.00–56.50 g
Earliness		
Very early varieties	in grade I	232–237 days
Semi-early varieties	in grade II	238–239 days
Semi-late varieties	in grade III	240–241 days
Late varieties	in grade IV	242–245 days
Stem rust		
Without infestation	in grade III	9 points
Isolated occurrence of chloroses on leaves	in grade III	8 points
Occurrence of small piles of rust with large chloroses, isolated piles also on stems	in grade II	6–7 points
Plants covered non-regularly by rust piles with chloroses	in grade I	5 points
10–30% plants covered by rust piles and small chloroses	in grade I	4 points
Rust piles on the spike of all plants	in grade I	3 points
Yellow rust		
Without infestation	in grade III	9 points
Isolated chloroses and necroses	in grade III	8 points
Isolated very small piles with chloroses and necroses	in grade II	7 points
1% leaf areas covered by small piles	in grade I	6 points
Infestation turns into focuses	in grade I	5 points
10% leaf area covered by rust piles in stripes	in grade I	4 points
Focuses turn into surface occurrence	in grade I	3 points
Leaf rust		
Not infested	in grade III	9 points
Isolated chloroses	in grade II	8 points
Isolated piles and great chloroses	in grade II	7 points
Leaves covered by rust piles up to 15%	in grade I	6 points
Leaves covered by rust piles up to 25%	in grade I	5 points
Leaves covered by rust piles up to 40%	in grade I	4 points
Leaves covered by rust piles up to 60%	in grade I	3 points

firms a known correlation between low baking quality and occurrence of secaline block GLD 1B3 (Sozinov, 1985). In addition, alleles Gld 1-1A4 ($V = 0.25^{xx}$) and 6B3 ($V = 0.29^{xx}$), based on association coefficients, participate in marking a low baking quality. The dependence between occurrence of allele Gld2-1AO ($V = 0.44^{xx}$) and a low baking quality was manifested unexpectedly.

The trend to improve the baking quality indicates allele Gld 1B4, likewise alleles Gld 1D1 and 1D2 which are distinguished by low tightness of dependence. An idea of higher marker value of allele Gld 6D2 (Sozinov, 1985) was confirmed in studied set of varieties ($V = 0.33^{xx}$).

Regarding marking 1 000-kernel weight (TKW), no close dependence between genes determining TKW and gliadin genes was found. Higher marking ability is indicated by allele Gld 6A(1) ($V = 0.21^{xx}$), though marginal values of the trait are not different, therefore allele Gld 6A(1) is inconvenient for determination of dependence between gliadin markers and TKW value.

Based on achieved association coefficients it can be supposed that resistance or susceptibility to stem rust is marked by several gliadin genes. Out of them the meaning for estimation of occurrence of genes of resistance have the following alleles: Gld 1-1A15 ($V = 0.33^{xx}$), 1-1A3 ($V = 0.35^{xx}$), 1B3 ($V = 0.44^{xx}$), 1D5 ($V = 0.37^{xx}$) and Gld 6B(1) ($V = 0.29^{xx}$).

The results achieved are in accordance with the knowledge about localization of gene Sr14 in chromosome 1A and gene Sr11 in chromosome 6B (McIntosh, 1973, 1983). The linkage between translocated gene of resistance to stem rust (Sr31) and occurrence of secaline gene Gld 1B3 (Sozinov, 1985) was also confirmed. The presence of the genes Sr18 and Sr33 in chromosome 1D (McIntosh, 1973, 1983) confirms a found marker ability of allele Gld 1D5.

According to the values of association coefficients marking of susceptibility to stem rust by alleles Gld 1-1A9 ($V = 0.37^{xx}$) and Gld ($V = 0.37^{xx}$) can be concluded.

Some resistance genes to leaf rust of wheat are marked by marker-genes, located in chromosomes 1B (Lr1), 1D (Lr21) and 6B (Lr3, Lr9, Lr 36) (McIntosh, 1983; McIntosh et al., 1992).

Association coefficients achieved show an ability of alleles Gld 1D1 ($V = 0.42^{xx}$) and Gld 6A2 ($V = 0.38^{xx}$) to mark resistance to leaf rust of wheat.

In evaluated set of varieties the linkage between gliadin genes-markers and resistance genes Lr9 and Lr3 located in chromosome 6B was not confirmed.

According to the values of coefficients an ability of gliadin alleles Gld 1B4 ($V = 0.37^{xx}$) and Gld 1D9 ($V = 0.35^{xx}$) to mark genes of resistance to yellow rust, located in chromosomes 1B and 1D (Morris, 1962–1973; McIntosh, 1983), is indicated. Significant dependence between alleles

Gld1 – 1A2 ($V = 0.37^{xx}$) and Gld 1D2 ($V = 0.48^{xx}$) and susceptibility to yellow rust was confirmed.

Based on association correlations found localization of genes influencing a length of the growing season (earliness, lateness) in chromosomes 1B, 1D and 6A can be judged. Regarding localization of photoperiodism genes (ppd1, ppd2, ppd3) and vernalization genes (Vrn1, Vrn3 and Vrn 5) in linkage groups not-marked by gliadin marker-genes these genes cannot be substituted (McIntosh, 1983; McIntosh et al., 1992).

It is evident from association coefficient values that allele Gld 1B1 ($V = 0.52^{xx}$) marks high earliness, while lateness is in the bond with allele Gld 1B4 ($V = 0.40^{xx}$) or with allele Gld 1D1 ($V = 0.33^{xx}$), respectively.

Highly significant marker of earliness seems to be also allele Gld 1D2 ($V = 0.39^{xx}$), while allele Gld 1D1 ($V = 0.33^{xx}$) is distinguished by the rate of occurrence just in late varieties. Allele Gld 6A1 ($V = 0.40^{xx}$) can be also considered as an earliness marker according to the association coefficient value.

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Received for publication May 15, 1995

ČERNÝ, J. – ŠAŠEK, A. – VEJL, P. – HANIŠOVÁ, A. (Česká zemědělská univerzita, Agronomická fakulta, Praha; Výzkumný ústav rostlinné výroby, Praha-Ruzyně; SELGEN – Šlechtitelská stanice, Stupice, Česká republika):

Markerování pšenice obecné (*T. aestivum* L.) stanovením aproximativní závislosti četnosti alelických gliadinových genů na kvalitativní třídě agronomického znaku.

Scientia Agric. Bohem., *26*, 1995 (4): 245–258.

Markerování agronomicky významných znaků pšenice obecné obvykle vychází z pracovně nákladné a časově náročné paralelní hybridologické analýzy a elektroforetické analýzy genetických markerů, dosud většinou bílkovinné povahy (gliadinů a podjednotek gluteninů s VMH).

Cílem práce je ověření metody markerování pomocí aproximativně stanovené závislosti mezi četností alelických gliadinových genů a kvalitativní třídou šesti znaků (pekařská jakost, hmotnost 1 000 semen, odolnost ke rzi travní, odolnost ke rzi pšeničné, odolnost ke rzi žluté, délka vegetace).

Předpokladem experimentálního stanovení asociace mezi četností alelických gliadinových genů a hodnotou markerovaných znaků je dostatečná genetická proměnlivost použitého experimentálního materiálu. Metoda byla proto ověřována na různorodém souboru 66 domácích a zahraničních odrůd a nových šlechtění pšenice ozimé, sledovaných v tříletých zkouškách výkonu (1990–1992) na šlechtitelské stanici SELGEN – Stupice.

K manifestaci gliadinových signálních genů bylo použito postupu vertikální elektroforézy ve škrobovém gelu (SGE) podle autorů Šašek et al. (1989). Alelické gliadinové bloky byly vyčleněny z elektroforetických spekter podle publikovaného katalogu (Sobko, Poperelja, 1986).

K stanovení závislosti mezi výskytem alel gliadinových genů (Gld1-1A, 2-1A, 1B, 1D, 6A, 6B, 6D) a kvalitativní třídou markerovaného agronomického znaku bylo použito χ^2-testu. Těsnost závislosti byla vyjádřena koeficientem asociace:

$$V = \sqrt{\frac{\chi^2}{n}}$$

Byla potvrzena účinnost sekalinové alely Gld 1B3 markerovat nízkou pekařskou jakost a prokázána rovněž schopnost alel Gld 1-1A4, Gld 6B3 a Gld 2-1A markerovat nízkou pekařskou jakost. Jako marker lepší pekařské jakosti se kromě alely Gld 1B1 (Sozinov, 1985) ukazuje i alela Gld 1B4. Alela Gld 6D2 neprokázala schopnost markerovat vyšší pekařskou jakost (Sozinov, 1985).

Závislost mezi geny determinujícími HTS a signálními gliadinovými geny nebyla prokázána.

Odolnost ke rzi travní markerují podle zjištěných koeficientů asociace kromě translokované alely Gld 1B3 (Sozinov, 1985) i alely Gld 1-1A5, Gld 1-1A3, Gld 2-1A(O), Gld 1D5 a Gld 6B(1). Analogicky byla potvrzena schopnost alel Gld 1D1

a Gld 6A2 markerovat odolnost ke rzi pšeničné a alel Gld 1B4 a Gld 1D9 značkovat odolnost ke rzi žluté.

Na základě hodnot zjištěné asociace lze předpokládat, že alely Gld 1B1 a Gld 6A(1) markerují ranost, zatímco alely Gld 1B4 a Gld 1D1 pozdnost.

pšenice obecná; gliadinové alely; markerování; koeficienty asociace; ekonomické znaky

Contact Address:

Prof. Ing. Jiří Černý, CSc., Česká zemědělská univerzita v Praze, Agronomická fakulta, 165 21 Praha 6-Suchdol, Česká republika, tel.: 02/338 25 54, fax: 02/338 28 01