ANNALS OF THE FACULTY OF ENGINEERING HUNEDOARA
2006, Tome IV, Fascicole 2, (ISSN 1584 – 2665)
FACULTY OF ENGINEERING HUNEDOARA,
5, REVOLUTIEI, 331128, HUNEDOARA

STUDY OF GLUTENINS FRACTIONS AT SOME CULTIVARE OF WHEAT

POPESCU Iuliana [1], PETRESCU Irina [2]

[1] BANAT UNIVERSITY OF AGRICULTURAL SCIENCES, DEPARTMENT OF BIOCHEMICAL, TIMISOARA,
[2] BANAT UNIVERSITY OF AGRICULTURAL SCIENCES, DEPARTMENT OF GENETICS, TIMISOARA

ABSTRACT
The unique properties of the wheat grain reside primarily in the gluten-forming storage proteins of its endosperm. Several high molecular weight glutenin subunits (HMW-GS) a have been closely associated with breadmaking quality.
The low molecular weight (LMW) GS are present in gluten at about three times the amount of the HMW-GS, but their size distribution means that they are difficult to study and the LMW-GS play a significant role in gluten structure.
The study was applied on an few romanian weath breeding.
KEYWORDS
Glutenin fraction, wheat

1. INTRODUCTION

The variability of wheat genotypes concerning their bread qualities is given, in most cases, by the composition of gluteins and gliadins.

The genes that control glutenin synthesis are placed on the long arm of group 1 chromosomes and have been named Glu-A1, Glu-B1 şi Glu-D1 (Payne et al., 1980, 1982), a number of alleic variants can occur on all 3 loci.

The literature says that gluteninic 1, 2*, 14+15, 17+18, 5+10; non alelic of Gli-A1 and Gli-D1, gliadins d2+d4, d3 and d7 have a positive effect on the bread qualities.

It has also been establish that, for example, the gluteninic grade, corrected in acordance with the presence of rye gliadins and grain hardness index, explained by 77 % the variation in the bread volume.

2. MATERIAL and METHODS

We analysed the composition of glutenic subunits having high molecular weight in 6 *Triticum aestivum* L. genotypes. The material was obtained in the Wheat Improvement Laboratory, at Fundulea and consists of varieties cultivated on large areas in Romania (Fundulea 29, Dropia, Fundulea 4, Delia, Alex, Rapid).

The proteins were extracted only from one grain, 10 grains being analysed from each genotype. In order to highlight the glutenins after B-mercapthoethanol reduction, the separation was carried out electrophoresis in polycrylamide supplemented with dodecyl sodium sulphate (SDS-PAGE), after the method described by Payne et al., (1979). Agluteninc grade was calculated for each genotype totalizing the points given to each subunit controlled by the same allele, depending on its influence on the bred qualities, after the method introduced by Payne (1986).

3. RESULTS and DISCUSSION

With the molecular weights of glutenin polymers reaching over twenty million daltons, based on gel filtration and flow field-flow fractionation (FFF) studies, glutenin proteins are among the largest protein molecules in nature.

Nevertheless, it should be stated that all measurements were based on the use of globular proteins as standards. These standards are relatively compactly folded whereas the glutenin polymers are largely not compactly folded. Thus, this type of calibration may tend to give anomalously high results. These proteins are heterogeneous mixtures of polymers formed by disulfide-bonded linkages of polypeptides that can be classified in four groups according to their electrophoretic mobility in SDSPAGE after reduction of S-S bonds (the A-, B-, C- and D-

regions of electrophoretic mobility). The A-group (with an apparent molecular weight range of 80,000–120,000 Da) corresponds to the HMW-GS.

The B-group (42,000–51,000 Da) and Cgroup (30,000–40,000 Da) are LMW-GS distantly related to γ- and a-gliadins. Finally, the D-group, also belonging to the LMW-GS group, is highly acidic and related to ω-gliadins (Fig. 1). The subunits of glutenin may also be characterized by capillary electrophoresis and by reversed-phase HPLC. These are valuable techniques that offer excellent resolution, automation, quantitation, and computerization. Based on separation by differences in charge and hydrophobicity, they can be used alone or complementary to other separation methods (mainly SDS-PAGE). For RP-HPLC, the component proteins show a wide range of hydrophobicities.

Fig. 1. Glutenins proteinogramă

A wide range of approaches has been used to provide better purification of the glutenin fraction. After Osborne's studies, Jones et al (1959) tested two different methods (ethanol 70%, pH fractionation) for precipitating glutenin from gluten. Burnouf and Bietz (1989) used dimethyl sulfoxide (DMSO) as a solvent for removing monomeric proteins (together with a few smallsized glutenins).

According to the proteingrams, the corresponding gluteininicgrades ranged between 9 (in Fundulea 29) and (Fundulea 4 and Delia). We should point out that all genotypes we should point out tht all genotypes we analysed have the subunit pair 5 +10, caracterized by Payne (1986) as harving a positive effect on the bread qualities. Table 1 presents the alleles of gluteninic subunits having high molecular weight and the gluteninic grades corresonding to the wheat genotypes we analysed. Generally, in all genotypes we analysed, β group has fractions with larger quantities of protein (fig.1).

TABLE 1. Gluteininic subunits with high molecular weight and the respective gluteninic grades in some *Triticum aestivum L*

Type	Genotype	The gluteninic subunits with high molecular weight and the diagnosed alleles						Grade
		Glu - A1	Glu - B1			Glu - D1		
		b	a	b	d	a	d	
IV	Fundulea 4			7+9			5+10	6
III	Rapid		7+8				5+10	7
III	Dropia		7+8				5+10	7
III	Alex		7+8				5+10	7
IV	Delia			7+9			5+10	6
II	Fundulea 29	2*		7+9			5+10	9

4. CONCLUSIONS

A significant number of studies confirmed the positive correlation between the gluteninic subunits 5+10, harving high and the bread qualities of gluten (elasticity, increase in the bread volume). We must further analyse a greater number of genotypes, in order to highlight other pairs of gluteninic subunits that are valuable for the bread qualities and carry out an indirect selection for this characteristic.

A great deal of research attention has been focused on the study of wheat gluten proteins in the past three decades. This is clearly indicated in the literature citations included in this review. While some areas have been thoroughly studied, others still need research attention. Particularly, the failure in obtaining complete solubilization of unaltered polymeric structures hinders a more robust evaluation of the relationship between glutenin and the quality of wheat-based products.

Because gluten quality is obviously a complex issue, we should not expect that a solution of the solubility question would result in a complete understanding of the problem.

REFERENCES

[1.] BUSHUK, W. 1994. Molecular structure of bread wheat glutenin. Pages 5-13 in: Gluten Proteins 1993. Association of Cereal Research: Detmold, Germany.

[2.] BURNOUF, T., and BIETZ, J. A. Rapid purification of wheat glutenin for reversed-phase high-performance liquid chromatography: Comparison of dimethyl sulfoxide with traditional solvents. Cereal Chem. 1989.

[3.] CORNISH, G. B. Wheat proteins and end-product quality, Proc. 45th Australian Cereal Chemistry Conf. Y. A. Williams and C. W. Wrigley, eds. RACI: Melbourne, Australia. 1995.

[4.] DANNO, G. Extraction of unreduced glutenin from wheat flour with sodium dodecyl sulfate. Cereal Chem., 1981.

[5.] JONES, R. W., TAYLOR, N. W., and SENTI, F. R. Electrophoresis and fractionation of wheat gluten. Arch. Biochem. Biophys.1959.

[6.] PAYNE, P.I. şi colab., – The association between γ-gliadin 45 and gluten strenght in durum wheat varietis: a direct causal effect or the effect of genetic likage, J. Cereal Sci 2.,1984