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UNIQUE HIGH MOLECULAR WEIGHT GLUTENIN SUBUNITS IN BREAD WHEAT (*TRITICUM AESTIVUM* L.)

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High molecular weight (HMW) subunits of glutenin proteins in hexaploid wheats are responsible for the elasticity of the dough essential for good bread-making quality. Unique HMW subunits of glutenin were detected in certain varieties of bread wheat of Japanese origin when single seeds of the same were evaluated for their gliadin banding patterns using electrophoretic screening techniques. These glutenin subunits could be utilized for grain quality improvement of cultivars through hybridization with promising bread wheat lines possessing other desirable attributes such as tolerance to biotic and abiotic stresses.

Bread wheat, *Triticum aestivum* L., is one of the most important crops in the West Asia and North Africa with an average yearly regional production of 63.4 million metric tonnes according to the Food and Agriculture Organization of the United Nations (FAO, 1992). The improvement of its industrial quality is, therefore, one of the principal breeding objectives in most bread wheat breeding programmes. To support plant improvement, landraces, old varieties and primitive forms have been extensively collected and preserved as a valuable current and future source of variation for desirable traits.

HMW glutenin is the storage protein (prolamin) constituent of bread wheat flour which gives elasticity to the dough prior to baking and hence contributes towards good bread-making quality. It comprises atleast 12 different subunits which are easily separated by sodium dodecyl sulphate (SDS)–polyacrylamide gel electrophoresis (PAGE). Some of these subunits have been extensively

studied since they are important for industrial bread-making quality (Burnouf and Bouriquet, 1980; Payne *et al.* 1979, 1980). Unique HMW subunits in certain previously cultivated Japanese bread wheat varieties were reported by Payne *et al.* (1983). These subunits had by far the lowest relative mobility and, therefore, probably the highest molecular weight of any HMW subunit of glutenin so far described in hexaploid wheat. Results of an electrophoretic evaluation of a collection of varieties of bread wheat and new sources for HMW glutenin proteins which could be used to improve bread-making quality of wheats is described in this article.

MATERIALS AND METHODS

A collection of 130 previously cultivated Japanese bread wheat varieties was donated to the Genetic Resources Unit (GRU) of the International Center for Agricultural Research in the Dry Areas (ICARDA) by the gene bank at the National Agriculture Research Center, Tsukuba, Japan. These varieties were screened electrophoretically with an aluminium lactate PAGE system, which revealed HMW gliadin storage protein banding coded by genes located on the short arm of chromosome 1D, using the method described by Tkachuk and Mellish (1980). Subsequently, the existence of the HMW glutenin subunits coded by genes located on the long arm of the 1D chromosome was confirmed experimentally using the SDS-PAGE technique described by Bietz *et al.* (1975).

RESULTS AND DISCUSSION

Using aluminum lactate PAGE analysis in our experiment it was found that the varieties Akasabi Shirazu, Aoba Komugi, and Shirasagi Komugi possessed the unique HMW gliadin subunits. The screening was repeated with SDS-PAGE when the variety Shirasagi Komugi clearly confirmed the presence of HMW glutenins (Fig. 1). Canadian bread wheat cv. Marquis and U.S. bread wheat cv. Chinese Spring, and wild relative *Aegilops umbellulata* were used for comparison.

Although such HMW glutenins have been reported previously in *Aegilops umbellulata* and other diploid *Aegilops* species such as *Ae. longissima*, and tetraploids *Ae. peregrina* and *Ae. kotschyi* (Galili *et al.*, 1988), they have been detected only once in hexaploid cultivated bread wheats (Payne *et al.*, 1983). However, it is unlikely that these subunits appear in Japanese varieties owing to

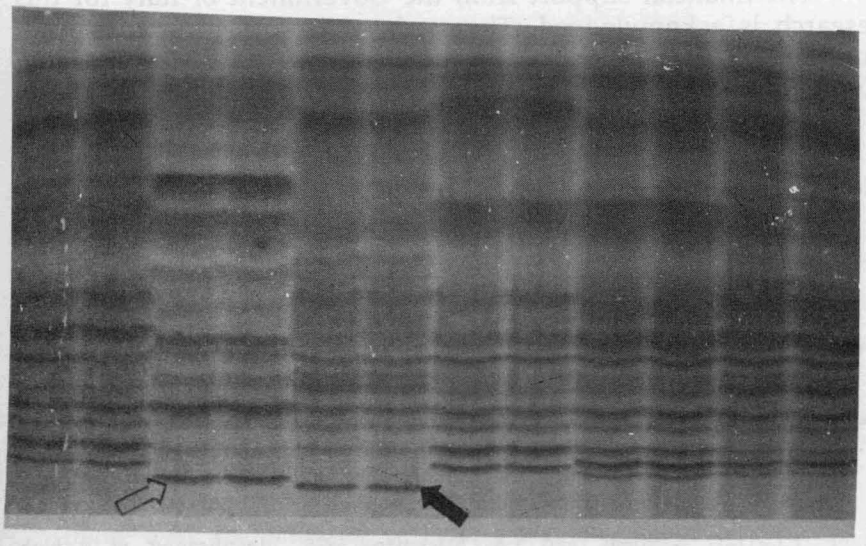

Fig. 1 : Electrophoregram of glutenins using SDS-PAGE technique. The samples are from left to right in twin tracks on the gel: *Triticum aestivum* cv. Marquis; Japanese varieties Akasabi Shirazu, Aoba Komugi, and Shirasagi Komugi (dark shaded arrow shows the very HMW glutenin band); *Aegilops umbellulata* also posses HMW glutenin but with a slightly higher mobility (unshaded arrow); and *T. aestivum* cv. Chinese Spring.

outcrossing with a diploid wild progenitor because (i) *Aegilops* species do not occur naturally in Japan (M. van Slageren, pers. comm.), and (ii) the relative mobility (Rm) of the HMW band in *Ae. umbellulata* is not sympatric with the HMW band of Shirasagi Komugi (Fig. 1). The novel subunits, it is hypothesized, may have arisen as a result of a recent gene mutation within the Japanese bread wheats rather than from any outcrossing which may have taken place in the field.

We hope to transfer these subunits through hybridization to other good quality and stress-tolerant bread wheat varieties in order to look at the possibility of improving extensibility (elasticity) of dough. After several generations of backcrossing with the selected good quality stress-tolerant breeding line parents, it could be possible to observe the positive effect of this unique HMW subunit on bread-making quality.

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