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Diversity of Gluten Proteins in Landrace Wheat Varieties Grown in Different Ecological Regions of Uzbekistan

A. Buronov
Chirchik State Pedagogical University, 111709, Chirchik, Uzbekistan

Abstract: Here was described full polymorphism of electrophoretic spectra of gliadines in wheat landraces of Uzbekistan comparing with commercial and newly zoned cultivars. It was conducted work on 21 landraces, 2 new and one commercial commercial variety that it was revealed 40 variation in electrophoretic spectra.

Keywords: Landrace wheat varieties, electrophoretic analysis, gliadins, grain quality, gluten.

A serious problem in the selection of most agricultural crops is their extremely narrow genetic diversity. Its solution is associated with the introduction of genetic material from wild relatives and related species, i.e., overcoming the erosion of the primary gene pool by including the secondary gene pool in it. However, the sharp reduction in the natural ranges of such potential donor species, as well as the narrowing of their polymorphism due to their maintenance in limited, small populations in gene banks not only leads to the erosion of their gene pool, but also reduces the potential for expanding the biodiversity of cultivated species [8].

Modern wheat varieties are mostly genetically similar and have a narrow genetic base. The genetic base of local varieties developed by farmers through natural selection for yield is broader and may include important aspects for breeding. Such varieties are characterized by tolerance to local stress factors, stable productivity, wide diversity in protein content and differ from commercial varieties in grain quality, so these varieties are valuable gene pools and play an important role as an initial source for developing new varieties [9].

Jaradat A.A. and others [10] note that landrace wheat varieties were developed by farmers as a result of many years of natural and artificial selection and adapted to local conditions. As a distinct plant population, ancient local varieties were planted by the population to fulfill social, economic, cultural and ecological needs.

Newton's [11] research shows that depletion of genetic resources and genetic erosion are serious problems in agriculture in many countries. Today, the replacement of ancient indigenous wheat varieties with varieties resistant to pests, diseases, biotic and abiotic factors, developed with the help of modern agriculture and its huge investments, has led to a decline in genetic diversity. He noted that it could be observed that in areas where indigenous wheat had been cultivated since ancient times, its potential had not been fully utilized.

Studying and conservation of the Uzbek wheat landraces is of great importance, since there are cultivars possessing high bread making qualities among them, and this character is genetically determinated and it does not depend on environmental factors met during its growing [1]. Comparative analysis of gliadins in diverse wheat varieties has revealed numbers of allele blocks on gliadin coding locus. Catalogues of protein constituents of gliadin blocks have been developed for soft bread (*Triticum aestivum* L.) [2] and spring durum (*Triticum durum* Desf.) wheats [3], and using them may allow identifying more than 20 million of genotypes.

Mass screening of the introduced into commercial growing and perspective wheat varieties using electrophoresis of their reserve proteins may purposefully allow to select samples for crossings and develop wide spectrum of variability in hybrid populations, and this could allow select forms having expected properties [4, 5].

Huge polymorphism of gliadin F-spectrum conditioned by the existence of multiple alleles of gliadin coding loci provides with a possibility to easily and effectively differentiate and identify wheat genotypes.

Materials and methods. Material for investigations were soft bread wheat (*T. aestivum*) landraces that have been collected in different regions of Uzbekistan. Analysis of grain reserve proteins (gliadins) have been done using single page electrophoresis in polyacrylamide gel in aluminum lactate buffer with pH 3.1 [2]. Gliadins were extracted from a flour of individual wheat grains by 70% ethanol. 100 grains per landrace variety have been analyzed and intra-varietal heterogeneity for each of varieties have been identified and described. To compile proteins formula, standard clustering spectrum has been used, and 30 gliadin components in that have been divided to α-, β-, γ-, ω-zones.

Results and discussion. Studying wheat landraces is of great interest concerning preservation of gene pool *in vitro* conditions and also as a genetic source of economically valuable traits in breeding process on creation of new varieties adapted well to local condition.

To study landraces of Uzbekistan, their samples have been collected from different regions of Uzbekistan. Morphological characters of samples were identified, and areas of their cultivation have been determined and mapped [6,12,13]. Samples were catalogued and characterized by grain quality and reserve proteins [6, 7,14].

As it has been reported previously [7] several wheat landrace samples under the same name Kyzyl Bugday were collected in mountain areas at altitudes more than 1500 meters above sea-level. All these samples had identical electrophoretic gliadin spectra. Further studies of these samples have revealed that one sample (named Kyzyl Bugday as well) from Saryosiyo district of Surkhandarya region has differed from others by absence of a component in ω-region of the spectrum.

Two more morphologically similar varieties of landraces have varied on their gliadin spectra. One of them named Ak Bugday has been collected in Kashkadarya region, and another one named *Graecum* was collected in Jizzakh region. Both of samples were with white spikes and and white colored grains and belonged to *Greacum* type but their gliadin spectra have been different.

Several samples collected were unnamed because farmers who have cultivated them did not give them any names. These samples have been divided into three groups taking into consideration their morphological and economically valuable characters studied and sites of collection. However, data of electrophoretic analyses have shown that these samples should be divided into two groups, where two samples collected from two sites of the same region have had different spectra (Fig.1, columns 6 and 7). Landraces Surkhak, Tyuyatish, Kalbugday (awnless), BoysunTura-2 and Kyzyl Sharq were polymorphic as well each having two or three spectra.

We have developed a Project aimed to collect and restore existed landraces endangered to be lost, to multiply them and bring back them to farmers for further cultivation. So, variety Kayraktash, drought tolerant, containing high amount of gluten, with medium-size plant height and moderate resistance to yellow rust, has been restored successfully. This landrace has been sown on 0.3 ha of unirrigated dryland area and 800 kgs of seeds were produced in 2014. These seeds have been cleaned and treated with fungicides. Seeds were delivered to farms for cultivation in drylands in Boysun and Altynsay dirsticts of Surkhandarya region. This restored new variety Kayraktash has been submitted to the State Variety Testing center for testing in dryland conditions. This variety had a homogenous electrophoretic spectra, having enriched components in α- and β-regions (Fig. 1, column 19).

Landrace of the durum wheat named Kara-Kiltik could be found seldom, and differed from other landraces by long, black awns, small spikes and relative compactness. Two biotypes of this landrace have been determined that differed by intensity of expression of one component in γ-region and absence of another component in ω-zone. An interesting landraces are Pashmak and Khivit having very long periods of vegetation. Pashmak has preserved its monomorphity but Hivit had two variables in electrophoretic spectra, differing by two minor components in ω-zone.

Commercial wheat variety Surkhak is cultivated in many regions of Uzbekistan where spring wheat is usually grown. It has been created in 1940's by selection amongst local landraces. It is relatively tolerant to drought and high temperatures. Its awned spikes, white, fuzzy glumes, and red seeds correspond to botanical characteristics of *Erythrospermum*. Electrophoretic analysis of reserve gliadin proteins of this variety has revealed four types of spectra, and polymorphism has been mainly in α- and β-regions.

Electrophoretic spectrum of Krasnodarskaya 99 variety is close to spectra of standard variety Bezostaya 1. Electrophoretic spectra of Ok-Marvarid and Bardosh had 2 and 3 types of electrophoregrams in α-region, respectively.

Thus, we have characterized full polymorphisms based on electrophoretic spectra of gliadins of Uzbekistan wheat landraces and compared them with those of commercial varieties and newly introduced into practice cultivars. 21 landraces, two new and one commercial varieties have been analyzed and 40 electrophoretic spectra were revealed. Ten of analyzed varieties were monomorphic and 14 ones were polymorphic. Many landraces cultivated at private farms of remote regions were monomorphic, but commercial varieties cultivated on large area were revealed to be polymorphic.

As a rule, during introduction of new varieties into commercial growing practice, attention is given mainly to their productivity, resistance to adverse factors, and bread-making quality of grain. All new varieties are high productive but they luck having good of bread-making quality. Wheat landraces cultivated in Uzbekistan and other Central Asian countries cannot compete with commercial varieties on productivity. However, these wheat landraces are extremely valuable as genetic source for improving grain quality, and these genotypes could be used in development of new varieties enriched with nutritious microelements and other ingredients beneficial for human's health.

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