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EVALUATION OF VARIETY OF OLD-SPRING SOFT WHEAT FROM THE SOUTH-WESTERN REGION OF UZBEKISTAN BY MORPHOLOGICAL AND MOLECULAR MARKERS

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ABSTRACT
It has been established that genotypes selected from old-seasoned spring soft wheat exhibit a wide variety in morphological features and composition of alleles of microsatellite loci located in chromosomes 2B, 5A, 5D, 7B and 7D. It was shown that within the southwestern region of Uzbekistan, alleles 413 and 412 of the Xgwm locus 257, 112 of the Xgwm locus 415 and 121 of the Xgwm 46 locus are most widely distributed.
KEYWORDS: *genetic resources, breeding, collections, genotyping, old wheat, molecular markers, polymorphism, DNA microsatellite locus, Shannon Index, cluster.*

INTRODUCTION

Plant genetic resources are an important source for ensuring the food security of any country. The role of plant resources for economic use was repeatedly emphasized by N.I. Vavilov [2; 8; 15; 16, 17].

In the last decade, the problems of conservation and rational use of plant genetic resources, which serve as the basis for the development of breeding, sustainable introduction of agriculture and ensuring food security, have received great attention throughout the world [11] which are the basis for the development of breeding [4]..

Genetic collections of agricultural plants are the basis for breeding work: the creation of new varieties, identification and utilization of donors and sources of valuable genetic traits, expansion of the regional industrial range with new varieties of domestic breeding [19].

Among the different types of collections, featured collections occupy a special place, since its composition contains significant stocks of genetic sources (duration of the vegetative period, resistance to diseases, lodging, productivity, quality of grain) for different areas of selection [5].

There are various criteria for the study of plant genetic diversity [13], among which morphological traits are classical descriptors of polymorphism of cultivated plants. However, the use of morphological features has several disadvantages, such as dependence on environmental conditions and subjectivity of assessment. All this can lead to the establishment of identical genotypes in the process of forming the collection. Therefore, alternative approach to optimizing the number of samples is the analysis of their genetic diversity by DNA markers, which provide the classification and structure the gene pool of a certain cultural species [10]. A number of authors [9; 6] advocated the use of molecular markers to study the diversity indices.

In the scientific literature there is information that for the characterization of genetic diversity and

genotyping of samples of wheat collection the most informative method is the analysis of polymorphism of microsatellite locus [7; 14; 18].

Despite several expeditions from Institute of Plant Genetic Resources to collect the gene pool of common wheat in Central Asia, the southwestern region of Uzbekistan are represented in small-scale and that too morphologically described, which is not enough to assess genetic and physiological diversity. Therefore, the assessment of the diversity traditional wheat varieties of this region by molecular markers and the identification of genotypes with valuable breeding traits is relevant. However, information on the genetic diversity of traditional wheat in the south-western region of Uzbekistan by molecular markers is lacking in the literature.

The purpose of this to study the polymorphism of Old wheat spring soft wheat on the basis of morphological features and microsatellite locus.

MATERIALS AND METHODS

The object of the study were 145 old-site sortable spring soft wheat collected from 30 sites and nine agricultural areas of the south-western region of Uzbekistan.

For the clustering of wheat varieties, the following morphological characteristics were studied: color and thickness of culm, height of culm, the form of shrub, productivity of shrub, leaf length and width, leaf dropping, waxy leaves, size, color and lowering of ears, coloring knot, spinning, shape and coloring of the ear, omission and length of the ear, the shape of the ear's head, the number of spikelets in the ear, the color of the grain, the number of grains in the ear and the size of the grain. Five microsatellite DNA locus were chosen to study the genetic diversity of the local wheat.

DNA from one two-three-week-old seedling was isolated using the STAB-method [12]. Analysis of microsatellites of known localization in the genome was studied by the method of polymerase chain reaction (PCR). Amplification was carried out with initial denaturation for 4 minutes at a temperature of 940 ° C and subsequent 30 cycles in this mode: denaturation — 30 s at 940 ° C, annealing primers — 23 s at 5 ° C, final elongation — 5 min at 7 ° C. The presence of amplification products was controlled by electrophoresis in a 3% agarose gel with ethidium bromide in a borate buffer with low ionic strength.

Electrophoresis was carried out in a HoeferSuperSub 100 horizontal instrument [1]. To assess the diversity of wheat varieties, the Shannon index [3] was used, which was calculated by the formula:

$$H' = -\sum_{i=1}^{S} (Pi \ln Pi)$$

where H'-is the Shannon index; S- is the number of categories (trait manifestations, locus alleles);

P_i - the frequency of manifestation of the trait.

The Shannon index is most often used to describe the polymorphism of plant morphological features [18]. At the same time, the correlation of the Shannon index with indices of genetic diversity is shown [20]. In this regard, in our work, we used the Shannon diversity index to estimate the polymorphism of varietal wheat varieties from morphological and molecular genetic data. The use of this index made it possible to compare the polymorphism of wheat varieties, described by various types of data - morphological and molecular - genetic.

The maximum possible value of the Shannon index (H_{max}) was calculated by the formula:

$$H_{max} = -\sum_{i=1}^{S} \frac{1}{S} ln \frac{1}{S} = \ln S.$$

The number of categories (S) was taken as the number of all gradations of each trait of allelic variants of the microsatellite locus in the total sample of wheat varieties studied.

The frequency of morphological signs / allelic variants of loci, the polymorphism index (PIC), the genetic diversity index Nei (D) were calculated in Excel using the *Micro Satellite Tools for Excel* setting.

To estimate the divergence between the local landraces of wheat, Nei genetic distances were calculated on the basis of a binary matrix ("+" - presence of a trait, "-" no trait) and trees were created by the method of nearest neighbors using the PHVLIP program.

RESULTS AND DISCUSSION

Polymorphism of old spring soft wheat by morphological features. With the phenotypic characteristics of old-place spring wheat samples from the south-western region of Uzbekistan, all studied morphological features were polymorphic. leaf raids, spinousness and coloration of the ear, the length and shape of the ear, the number of spikelets per ear, the shape of spikelet scales. The average number of gradations for a single trait for the local wheat of Kashkadarya, Surkhandarya and Samarkand regions was 2.26 ± 0.06, 2.20 ± 0.04 and 2.24 ± 0.08, respectively, and in the total sample 2.43 ± 1.11.

The maximum value of the Shannon diversity index (H') of off-farm wheat was noted on the basis of grain coloring (H' = 1.30). Signs of the number of spikelets per spike and grain size differed by a significant level of diversity (H'= 1.15 and 1.29, respectively).

The results of the studies showed that the least variable in the total sample of local land wheat were signs of spike attitude (H '= 0.29) and ear coloring (H' = 0.38). The overall level of polymorphism of land-borne varieties of spring soft wheat in all the studied morphological features for the Kashkadarya, Surkhandarya and Samarkand regions was 0.76 ± 0.26, 0.73 ± 0.27 and 0.74 ± 0.30, respectively, and the total sample of variety samples is 0.78 ± 0.33 (Table 1).

Table-1
The Shannon Diversity Index (H ') based on the morphological features of old-site spring soft wheat

Signs of	Administrative areas				H_{max}
	Kashkadarya	Surhandarya	Samarkand	Total sample	
Stalk Coloring	0,56	0,61	0,72	0,76	0,85
Stalk thickness	0,58	0,81	0,93	0,83	1,13
Stem height	0,73	0,86	0,89	0,97	1,11
Bush shape	0,54	0,90	0,62	0,87	1,13
Productive tillering	0,65	0,38	0,43	0,48	0,64
Leaf length	0,69	0,94	0,89	0,90	1,06
Leaf width	0,89	0,65	0,71	0,73	1,10
Leaf drop	0,81	0,70	0,59	0,74	0,69
The presence of waxy leaves	0,83	0,68	0,78	0,76	1,08
Size of ears	0,38	0,31	0,42	0,39	0,75
Coloring ears	0,00	0,45	0,64	0,38	0,70
Ptosis of ears	0,61	0,41	0,59	0,46	0,68
Coloring knots	0,67	0,70	0,62	0,69	0,74
Spike ear	1,18	1,06	1,10	1,12	1,34
Spike shape	0,74	0,54	0,38	0,41	0,58
Coloration	1,04	0,51	0,62	0,98	1,37
Spike	0,39	0,42	0,27	0,29	0,63
Spike length	0,94	0,81	0,69	0,96	1,38
Spikelet Form	0,61	0,44	0,50	0,48	0,73
The number of spikelets in the ear	1,10	1,02	1,06	1,15	1,29
Grain coloring	1,30	1,28	1,15	1,30	1,83
The number of grains in the spikelet	1,11	1,03	1,08	1,13	1,24
Grain size	1,08	1,26	1,32	1,29	1,78
Average by all indications	0,76±0,29	0,73±0,27	0,74±0,30	0,78±0,33	1,04±0,36

Consequently, old-town spring soft wheat from the south-western region of Uzbekistan was characterized by a similar level of polymorphism by morphological characteristics with the greatest predominance of the Shannon index in wheat varieties from the Kashkadarya region. There was a high level of variability in the total sample of varieties compared with the maximum value of the Shannon diversity index (Hmax = 1.04 ± 0.36).

The results of a comparative quantitative assessment using the Shannon index showed that the complex of studied traits showed the widest variety in most traits: color (1.83) and grain size (1.78), somewhat narrower along the length of an ear (1.38), spindles (1.34), the number of spikelets in the ear (1.29), the number of grains (1.24) and the height of the stem (1.11). The lowest index value is obtained by the presence of leaf omission (0.69) and an ear (0.63), productive bushiness (0.64) and the shape of an ear (0.58).

The data obtained indicated that the old local spring soft wheat from the southwestern region of Uzbekistan is characterized by a wide variety in morphological, phenological and other characteristics.

The results of the conducted studies have shown that the least variable.

In order to obtain extensive information on the geographic variability of characters and the diversity of old-site spring soft wheat, it was important to understand how different forms of wheat with similar phenotypic characters could form within the same region. To identify the structure of the diversity of old-place spring wheat, conventionally combined variety samples into four main clusters.

The first cluster consisted of 5 samples of different ecological and geographical origin, collected from three agricultural areas of the south-western region of Uzbekistan. For varieties of the first cluster is characterized by anthocyanin color of the stem; closed bush form; long and wide leaves with a strong lowering and the presence of a waxy coating; the long size of the ears with a purple color and lowering. It should be noted, however, that in this group were included varieties with an oval spikelet scale, which were characterized by a large number of spikelets in the ear; the color of the grain is red with a large size and elongated shape.

The second cluster included seven spring soft wheat varieties, differing from the previous group in stem thickness, erect bush shape, medium stem length, short green ears. The variety samples included in this cluster are almost identical for all other morphological

characters with those of the first cluster. However, it should be noted that the variety samples of this cluster, by morphological features, can be considered as one identical ecological group of wheat. The cultivars belonging to these clusters (clusters 1 and 2) were genotypes representing the specimen specimens that were collected in geographically closely located agricultural areas of the south-western region of Uzbekistan.

Cluster 3 included 6 local samples of spring soft wheat collected from four agricultural areas of the south-western region of Uzbekistan. It should be noted, however, that the variety samples of this group differ from the variety samples of the previous clusters by the appearance of representatives from the violet coloration of the stem with pigmentation during the period of ripening; the semi-developed form of the bush; short and narrow leaves with a green color. One of the distinguishing features of this cluster of wheat is the presence of representatives with a spindle-shaped spike shape with a lance-like spikelet scale. In this group, the variety samples also differed with small (weight 1000 grains 26.1 g) and medium (weight 1000 grains 30.61 g) seeds, bases with ovoid shape of the middle groove (Table-2).

However, it should be noted that most genotypes The third cluster has similar morphological features with the previous clusters, which indicates the common origin of these clusters.

The fourth cluster included 4 local samples of spring soft wheat, collected from 5 high-mountainous agricultural areas of Kashkadarya and Surkhandarya regions of the south-western region of Uzbekistan. It should be noted that the wheat of this group strictly differ from the previous clusters in color and grain size, which are not found in representatives of other clusters. So, for example, for the old local varieties of spring soft wheat Sabzak, Dashnabadi, Narmoi and Boboi, the ovoid shape of the grain, yellowish-red color and vitreousness, which are characterized by a very large grain size (weight of 1000 grains reaches 48.7 g and more), are characteristic.

The results of a comparative assessment of geographic variability of characters using the Shannon index showed that old-town soft wheat from the south-western region of Uzbekistan is characterized by a wide variety in morphological and phonological characteristics, parameters of plant productivity.

In the study of polymorphism and clustering of old-site sortable spring soft wheat from the south-western region of Uzbekistan, it was shown that local wheat may contain intra-variety groups of plants, which are characterized by the presence of a large number of genotypes that are more homogeneous in phenotypic characteristics. In this regard, for a more reliable differentiation of the gene pool of old-site of spring soft wheat characterized by the presence of various genetic close groups, it is advisable to use not only morphological, but also molecular markers that allow you to determine the level and nature of polymorphism of old-local varieties of soft wheat.

Table-2

The structure of clusters obtained on the basis of variability according to the morphological features of old-site spring soft wheat

Signs of	Clusters			
	1	2	3	4
Stalk Coloring	Anthocyanin	Anthocyanin	Violet (with anthocyanin) before maturation	Anthocyanin green
Stalk thickness	Fat	Thick with wax on summer	Thin	Thin without wax
Stem height	High	Medium	Low	Medium plant with straw
Bush shape	Closed	Upright	Semi-undeveloped	Developmental
Productive tillering	Large	Medium	Small	medium
Leaf length	Long	Medium	short	Very short
Leaf width	Wide	Medium	Narrow	Very narrow
Leaf drop	Strong	Medium	Weak	Not omitted
The presence of waxy leaves	Strong	Medium	Weak	absent
Size of ears	Long	Short	Wide	Narrow
Coloring ears	Violet with anthocyanins	Green	Violet without anthocyanin	Violet
Ptosis of ears	Strong	Medium	Weak	Not pubescent
Coloring knots	violet	green	Purple green	Violet with anthocyanin
Spike ear	aristate	aristate	Half shell	With points
Spike shape	Cylindrical	Pyramidal	Spindle-shaped	Lightly visible

Spikelet Form	Oval	Ovoid	Lanceolate	Slightly oval
The number of spikelets in the ear	Large	Medium	Small	Large
Grain coloring	Red	white	Bluish red	Yellowish red
The number of grains in the spikelet	More	Medium	Small	Very big
Grain size	Large	Medium	Small, medium grooves	Very big

Table-3

The values of the Shannon diversity index, polymorphism and Nei genetic diversity in microsatellite locus in old-site varieties of spring wheat

Locus	Shannon Diversity Index (H')				Polymorphism index (PIC)					Genetic Diversity Index (D)			
	Kashka-darya	Surhan-darya	Samar-kand	Total sample	H_{max}	Kashka-darya	Surhan-darya	Samar-kand	Total sample	Kashka-darya	Surhan-darya	Samar-kand	Total sample
Xgwm 257 (chromosome 2B)	0,78	0,54	0,60	0,84	1,12	0,48	0,35	0,38	0,51	0,54	0,43	0,38	0,56
Xgwm 46 (chromosome 7B)	0,52	0,31	0,33	0,54	1,14	0,28	0,18	0,21	0,30	0,41	0,19	0,22	0,43
Xgwm 196 (chromosome 5D)	1,05	1,03	1,01	1,43	1,48	0,49	0,46	0,50	0,75	0,689	0,54	0,64	0,78
Xgwm 44 (chromosome 7D)	1,40	1,62	1,73	1,81	1,84	0,70	0,64	0,78	0,80	0,78	0,81	0,83	0,84
Xgwm 415 (chromosome 5A)	0,74	1,12	1,03	1,08	1,43	0,39	0,56	0,61	0,64	0,43	0,56	0,70	0,65
The average value for all locus	0,89±0,78	0,92±0,83	0,94±0,86	1,14±1,40	1,40±1,52	0,47±0,36	0,44±0,34	0,50±0,51	0,60±0,61	0,57±0,52	0,51±0,49	0,55±0,49	0,65±0,62
Correlation coefficient H' CPIC						0,986	0,985	0,984	0,982	0,979	0,976	0,969	0,980

Old-place polymorphism of spring soft wheat along microsatellite locus

Differentiation of the gene pool of old-place sorbents of spring soft wheat in the southwestern region of Uzbekistan in accordance with the ecological and geographical origin of the forms is clearly shown in AFLPS-labeling.

To identify the geographical variability and diversity of local wheat, the DNA polymorphism of 5 microsatellite locus (MC loci), 125 genotypes of randomly selected and 5 local land spring wheat, which were identified using markers: Xgwm44 (7D chromosome), Xgwm46 (7B chromosome), were studied. Xgwm190 (chromosome 5D), Xgwm257 (chromosome 2B) and Xgwm415 (chromosome 5A).

The selection of genotypes was carried out in such a way that they represented all the original varieties of old-place wheat by origin and botanical varieties.

A comparative analysis of the diversity of genotypes for microsatellite loci (MS loci) showed that for old-town sortirant wheat wheat of the south-west of Uzbekistan is characterized by a wide variety in terms of the occurrence and composition of alleles of MC locus. (Table 3).

In the set of genotypes studied, the minimum number of alleles (4) was found for the MS loci Xgwm44 and Xgwm415, and the maximum for the MS locus Xgwm190 (8) and Xgwm46 (12). The most polymorphic were the MS loci Xgwm190 (H '= 1.43) and Xgwm44 (H' = 1.81).

For more extensive information on the polymorphism of the MS loci of old-site sorted wheat wheat, the indices of genetic diversity were also calculated: polymorphism index (PIC), Nei genetic diversity index (D), which had high correlations with the Shannon diversity index (H'). Consequently, these results allow descriptions of molecular - genetic data using the Shannon diversity index, which simplifies the comparison of morphological and molecular data.

The average number of allelic variants per locus in a common sample of varieties was 3.18 ± 1.80, which is 2.28 ± 1.18, 2.36 ± 1.27 and 2.38 for the Kashkadarya, Surkhandarya and Samarkand varieties. ± 1.32, respectively. Consequently, the genetic diversity of old-place wheat varieties in all loci according to the Shannon diversity index was 1.14 ± 1.40 (Table 3). Compared to the maximum value (Hmax = 1.40 ± 1.52), wheat varieties at the MC loci had a significant level of variability. It should be noted that the maximum possible value of the Shannon index is calculated for the number of allelic variants presented in the studied sample of varieties. The Nei genetic diversity index, which takes into account the distribution of allelic gene variants according to the Hardy-Weinberg law (Dmax = 1), indicates the average level of variability of Kashkadarya, Surkhandarya and Samarkand old local varieties of spring soft wheat in microsatellite loci (D = 0.65 ± 0, 62).

Comparison of the values of genetic distances, calculated on the basis of the polymorphism of microsatellite loci and morphological traits, between old-site varieties of spring wheat, indicates a greater differentiation of the local wheat gene pool according to molecular data than phenotypic. For example, the maximum Nei plant between the varieties Tiromokhi and Normoi, Surkhak and Safedaki mahali, Sabzak and Safedaki mahali was 0.0622874, the minimum - 0.00000 between Bahori and Safedaki mahali.

As a result of clustering of old land varieties of spring soft wheat by the method of joining the nearest neighbors with subsequent bootstrap analysis, four clusters were conventionally distinguished (Fig.1.).

A comparative analysis of the structure of the isolated clusters showed that the following products were amplified in monomorphic microsatellite loci of local wheat varieties: Xgwm 44 (168 nn, Pakhngandum); Xgwm 257 (201 bp, Obi-lalmi). In this group of varieties, the remaining loci were polymorphic and differed by the following set of allelic variants Xgwm 46 (260,121,178 bp), Xgwm 190 (177,173.99 bp), Xgwm 415 (135,121 bp), (Table-4).

For the MS, locus 44 (chromosome 7D), in the local variety Pahngandum, a unique allelic variant of 184 bp was found that was not found in any of the varieties in this sample.

In MS, the Xgwm 46 locus (chromosome 7 B), 12 alleles were detected. Among them, the 260 bp allele variant was unique for the Safedaki variety — bakhori, and 121 bp, rare for the local sorts of Obi — lalmi and Khibit. In the analysis of the pedigrees of the local varieties of spring soft wheat, included in this cluster, common ancestors were not identified.

The second cluster included variety samples of agricultural areas of Kashkadarya and Surkhandarya regions. In terms of the number of allelic variants, this group of varieties is characterized by a high level of polymorphism compared with varieties included in cluster 1. In the varieties of this cluster, 9 allelic variants were identified for all studied microsatellite loci. It should be noted, however, that the genotypes of this group differ from the cluster 1 genotypes by the presence of the following allelic variants: 121 and 190 pn (Xgwm 46), 99 and 173 pn (Xgwm 190), 201 bp, (Xgwm 257), 135,260 n.n., (Xgwm 415).

Table-4
Structure of Clusters of Old-place Spring Soft Wheat Produced Based on Microsatellite Loci Polymorphism

The size of the allelic variant of the locus, p n	Clusters			
	1	2	3	4
Xgwm 44	168	168,184	168	168
Xgwm 46	260,121,178	121,190	121,190,260	121,149
Xgwm 190	177,173,99	99,173,413,178	177,186	99,177
Xgwm 257	201	201	201	201
Xgwm 415	135,112	135,260	135,112	135,112

According to MS - Xgwm locus 257 (chromosome 2B), the variety Vatan revealed a unique allelic variant of 201 nn, which was not found in the sample of the studied varieties. In the set of genotypes studied, in addition to unique alleles, rare and frequently found allelic variants were also identified. The rare allelic variants included 413 bp of the Xgwm 257 locus, which was found in genotypes, selected from the variety Kanagandum and Vatan.

According to MS - locus 415 (chromosome 5A), in the Safedaki mahali variety, a unique allelic variant of 135 bp was found, and 112 bp (Hupar) were rare, which are characteristic of the variety samples of highland agricultural regions of the Kashkadarya and Surkhandarya regions. The allelic variant of 178 bp, locus Xgwm 190 is characteristic only for the variety Surkhusha and Bakhori, and is not found in other varieties included in this cluster. In this cluster, 3 nodes were identified with a high level of confidence. Boostrep - the values for a pair of old land grades Vatan and Surkhusha, Khupar and Kayraktash, Bakhori and Safedaki Mahali were 68.89 and 91%, respectively. The genealogical analysis of the local varieties Vatan, Hupar and Kayraktash showed that they have common ancestors, (Figure 1).

Thus, cluster 2 can be called a group of varieties originating from the Surkhusha variety.

Cluster 3 is represented by six land-borne varieties of spring soft wheat, originating from the agricultural regions of Samarkand and Kashkadarya regions. It should be noted that the following distinctions from cluster 2 varieties are characteristic of the varieties of this group: the Xgwm 44 locus (chromosome 7D) is represented by the 168 bp allele, the Xgwm 46 locus (chromosome 7B) with the alleles 121.190, 260 bp, the Xgwm locus 190 (5D chromosome) - 177, 186 bp, Xgwm 257 locus (chromosome 2B) - 201 bp, and Xgwm 415 locus (chromosome 5 A) - 135, 112 bp.

In cluster 3, no nodes were identified with high confidence. However, the local varieties Lalmi and Ob, which form a common node, have a common origin. In their pedigrees there is Safedakitiramohi.

Cluster 4 is represented by four landowned spring soft wheat from the northeastern agricultural regions of the Kashkadarya region, which formed two nodes. These landraces were characterized by a similar set of allelic variants characteristic of cluster 3 varieties. However, the Xgwm 46 locus in these varieties showed a product of 149 bp in size, and the Xgwm 190 locus revealed an allelic variant of 177 bp, and in Xgwm 257 - 201 bp, Xgwm 415 - 135, 112 bp

An amplification product of 112 pn in size on the Xgwm 415 locus was detected only in the Dashnabadi variety. The varieties Narmoi and Boboi are combined with a high degree of accuracy. As a result, clustering of old land varieties of spring soft wheat from the south-western region of Uzbekistan showed their significant differentiation compared with grouping by morphological features.

In the NJ– tree, built on the basis of morphological and molecular data, a large number of nodes with high bootstrap values are noted. Despite this, the genotypes of many old-spotted spring soft wheat on the studied microsatellite loci are similar to each other, which is probably indicated by the presence of a large number of nodes with high accuracy.

Thus, as a result of a comparative analysis of polymorphism of old-site spring soft wheat from the south-western region of Uzbekistan by morphological and microsatellite loci, their level of genetic diversity of variety samples was revealed.

It has been established that the genotypes of spring soft wheat selected from the landraces are characterized by a wide variety of microsatellite loci in their composition.

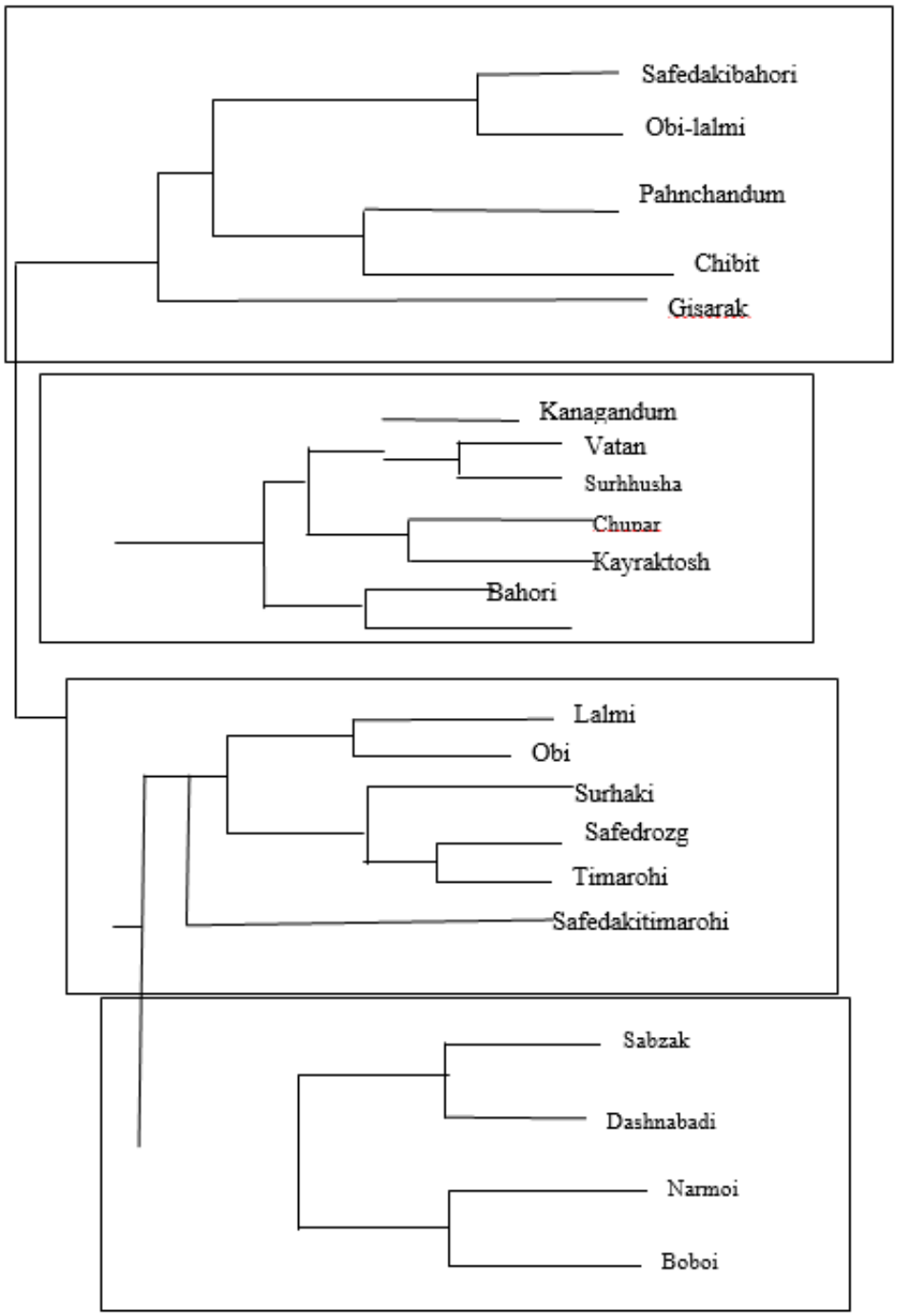

Figure 1. An agreed NJ-tree, reflecting the interrelationships of old-town sorbents of spring soft wheat from the south-western region of Uzbekistan, built on the basis of 15 morphological traits and 5 microsatellite loci.

In the set of selected genotypes for five microsatellite loci, 34 alleles were identified, of which 20.6% were rare and 17.6% were unique.

A comparative analysis of microsatellite loci has shown that three types of genotypes are characteristic of old-site spring wheat from the south-western region of Uzbekistan, among which the most widespread geographical distribution are the Xgwm 46, 177, 99 loci Xgwm 190 and 135, 112 loci Xgwm 415, which indicate a common gene pool of old land soft wheat in this region.

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