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Origin of cultivated species of tetraploid wheat

Abstract. Resintez of kinds showed the method of genetic analysis, that many of tetraploid types of wheats it is impossible to examine as independent taxonomical units. On the basis of genetic analysis it offers to plug in the group of tetraploidea only four kinds: *T.dicoccoides* Korn., *T.timopheevii* Zhuk., *T.araraticum* Jakubz., *T.dicoccum* Shubl. All other kinds (durum, turgidum, persicum, polonicum, aethiopicum) behave to the natural ecology- geographical categories.
Key words: genes, culture, maternal, paternal, phenotype, morphogenetic processes.

Introduction

Since the publication of classic works [Linnaeus C., 1753, Percival J., 1921, Flyaksbergera KA, 1935] questions about taxonomy of wheat - the most important culture of the northern hemisphere - seemed certain: the main system was established, artificially created or discovered in nature new types complemented, but did not change the accepted scheme.

Once it was established that two of the three genomes of tetraploid wheat come from the family of Aegilops there is a need to reconsiderthe acceptedsystem of classification, since according to some scholars [Bowden WM, 1966; Riley R., Chapman V., 1966 Morris, R., 1969 E. Sears et al.] intergeneric hybrids cannot be attributed to the genus of one of the parents. They offered to combine the genus Aegilops and Triticum asallopolyploid relatives of wheat, saving the specific names where it is possible: he offered to call Aegilopsovata as Triticumovatum, Aegilopscrassa - Triticumcrassum. The proposal done by Bowden VM, was strongly argued [Zhukovsky PM, 1985b., VF Dorofeev, Filatenko AA, 1979, Goncharov NP, 2002 et al.]. However, currently many genetics abroad follow the taxonomy proposed by V.M.Bowden.

Among wheat taxonomists there is no shared opinion on the number of species in the genus Triticum L. Some taxonomists follow the differential (comparative- morphological) wheattaxonomy and consider them as wheat of 26-29 species [VF Dorofeev and dr.1979, Zhukovsky PM, 1971; Goncharov NP, 2002], and a number of taxonomists recognize the 14-15 wheat species as independent[Sinskaya EN, NI Vavilov, 1935a]. On the other hand, genetics from foreign countries recognize only 3-6 species of the integral (polyploid and desynaptic) wheat system as independent [Mac Kay J., 1969; Morris, R., E. Sears, 1969]. Kay J. Mack., In 1968, based on the results of genetic analysis, proposed to enlarge the species: in the group of tetraploid wheat, he singled out only two types: T. timopheeviiZhuk (AbAbGG). and T. turgidum L (AuAuBB). In the latter, a whole variety of tetraploid wheat considered as subspecies - subsp: carthlicum, subsp. dicoccum, subsp. georgicum, subsp. dicoccoides, and durum, turanicum, polonicum conv. ssp. turgidum. Thus, they are the right species-specific processes and recognize only polyploidization and desynaptic system timpheevii and Zhykovskyi. Species - in our understanding is a polyploid series, which has a different genomic composition, the same ploid level and dissimilar economically valuable and biological properties. The study of their biological characteristics (crossability, vitality, fertility) and formative nature of the splitting process in interspecific crosses provide material to clarify the phylogeny of wheat.

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Materials and methods

We carried out the crossbreeding of different varieties between six types T.durum, T.turgidum, T.rersicum, T.aethiopicum, T.polonicum, T.turanicnm, and T.durum c T.aestivum.

Interspecific hybrids F1-F3 described in detail while determination of species and varietal features of wheat according to K.A. Flyaksberg. Due to the complex of morphological features all segregates of interspecific hybrids of the second and subsequent generations are divided mainly into three groups: maternal, paternal (approaching the maternal and paternal) and intermediate between the parental forms. Starting with F_2 and subsequent generations, the process of splitting, formative process of hybrid populations including the sixth generation was traced.

Results and their discussion

Hybridization of F_2-F_3 and formative processes of interspecific crossbreeding. According to the morphological features, the breed of interspecific hybrids of 28 chromosomes and the diversity of forms are divided into 5 groups: 1st type- maternal, 2nd - paternal, 3 and 4th type are related to the maternal and paternal and 5th - intermediate forms. The amplitude of variability of splitting differs depending on the combination and the direction of crossbreeding.

The greatest number of plants refers to the Ethiopian group (79%), Persian (62%) and Turan (47%) of wheat. The smallest number of plants refers to *T.durum* (19%), *T.turgidum* (35%).

On the basis of the study about the splitting of interspecific hybrids it was discovered that the generic features which characterize *T.aethiopicum* is the dominant characteristics of the phenotype *T.turgidum*, *T.durum*, *T.persicum*, *T.polonicum*, *T.turanicum* and are controlled by more complex polymeric genes. Very often thetetraploidhybrids increase or decrease in the quantitative traits of F2 and F3in subsequent generations of hybrids.

In some cases, there was transgressive inheritance of quantitative features (length and density of the ear and glumes at spike productivity, the length of the growing period). Along with the typical form of ear glumes characterizing parental forms of wheat, in all combinations there are split forms which are not characteristics of morphological features of the parental species and forms: densely spiked or more small forms, short, narrow, flat ears and glumes with more clearly or weakly pronounced keel; blunt or evidential tooth and a variety of other forms of glumes and teeth.

In cross breedings of *T.turgidumvar. salomonis*, *T.persicumvar.fuliginosum* and *T.durum* (Kharkovskaya-46) with other types of F_2 there appeared the coarse flat ears from type of dicoccum, and even forms resembling the type *T. dicoccoides*.

New formations with the features of other species (within the tetraploidwheats) were observed in almost all combinations of crossbreeding. So, Abyssinian hard wheat, characterized by mild spike construction (*T.durumsubspabyssinicumvav*) appeared in the following combinations: *T.turgidum. var. herrorae* x *T.turanicumvar.notaibil*; *T.persicumvar. fuliginosum* x *T.turgidum* (43174); normal durum wheat (T.durumDesf.) in crossbreedingT.persicum (38526) x T.durum subsp. abyssinicum (K-19289), *T.polonicum* (21441) x *T.turgidum* (43174). In crossbreeding *T.turgidum* (43174) with *T.persicum* (K 38526), *T.persicum* (K 38526) with *T.persicum* (K 7887) and *T.turanicum* (K 39319), among segregates emerged plants with features of T. dicoccum and transitional forms: *T.duro - dicoccum*, *turanico - dicoccum*, *tugrido - dicoccum*, *T.dicocco–aethiopi*

Thus, it is obvious that the species characterizing features as hereditary factors are quantitative and environmentally secured during prolonged evolution by natural and artificial selection. From the above studies it can be concluded that all kinds of cultural tetraploidwheats were produced by recombination of hereditary factors that contributed to the appearance of many new forms and types of features and species not been participating in crossbreeding in different recombinants. And the absence of clear morphological characteristics and genetic barrier, full compatibility of genetic homologyand morphogenetic processes allow us to combine all kinds of cultural tetraploid wheat into one group of naked tetraploid species of the ancestors, which were the types of *T.dicoccum* and *T.dicoccoides*.

Particular behavior of *T. timopheevi* Zhukob when crossed with tetraploid species can be explained by its apparent structural differentiation of chromosomes during evolution. It may be noted that in addition to polyploidy, a species-specific system in the process of evolution is the transformation of wheat spikelet stem breakage, the transition from spontaneous and semi-spontaneous type of spike to easily threshed form. In this regard, the spontaneous spike breakage of *T.dicoccoides*, semi-breakage of *T.dicoccum* in the group of tetraploid wheat regarded as species-specific system of cultivated wheat.

Our study found that the feature of «fragility» of the spike (*T.dicoccum* and *T.dicoccoides*) is a polygenic dominant and controlled by 3 or more dominant genes. The presence of this gene into wheat genotypes of tetraploid species, a characteristic of light threshing spike of type durum, turgidum suppressed, controlled respectively by two or more recessive genes (q). As for the other tetraploid wheat that the factor q is not only in *T. rersicum*, but perhaps the same genotype can be laid in *T.aethiopicum* Jakubz.

This fact is confirmed by crossing *T.durum*, *T.polonicum* with *T.aethiopicum*, since in F2 the plants with easy threshing spike of the type persicum (q - factor) and persicoides are split. Based on experimental studies of species of wheat we can argue that cultural spelled dicoccum descended from the wild coarse-grained wheat due to the genetic rearrangements during the cultivation in natural and artificial conditions within series of mutations in natural selection. In the future, under the influence of geographical divergence there is a possibilityof ecological isolation and increasing farming spelled differentiated eco-geographical groups and modern cultivated wheat (ECOTA subsp: durum, turgidum, aethiopicum, polonicum, et al.).

For a long natural evolution that occurred with 'emmer' wheat, and then it was widely dispersed together with a mankind of the globe in the high mountains. Under the influence of this fact, various morph ecological types were differentiated. Within the basis of the difference in morphological features of environmental groups there is the divergence of the genetic structure of populations. In this respect, the height above sea level, apparently, is the main factor (laboratory) to allocate in the formation of ecological types (*T.durum*, *T.turgidum*, *T.aethiopicum*, *T.polonicum*, etc.). Summing up the above, cultural evolution of tetraploid wheat species can be represented as a scheme [Zhangaziev AS, 2010] (Figure 1).

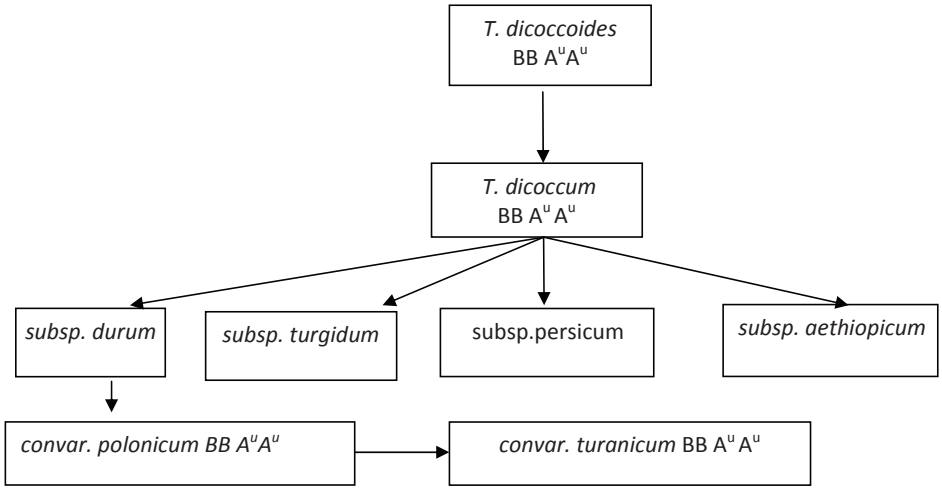

Figure 1 – Differentiation on environmental species and subspecies and cultural origins of tetraploid wheat species

Thus, we have as a result of a review of all views in taxonomy of tetraploid wheat (28 chromosomes) we propose to include only four species: *T.dicoccum*, *T.araraticum*, *T.dicoccoides*, *T.timopheevii*.

Resynthesis species by genetic analysis has shown that many species of tetraploid wheat cannot be regarded as independent taxonomic units. They belong to the natural ecological and geographical categories subsp: durum, turgidumaethiopicum, persicum, polonicum.

Conclusion

Genetic analysis of the specific characters of marking cultural wheat chromosome 28 was conducted for the first time: *T.persicum* Vav (persicoides), *T.durum* ssp.abysinicum Vav (inflatum), *T.turgidum* (turgidus), and the types of signs marking types «kilya» glumes, lightweight threshing spike *T.rersicum* type «q», *T.durum*, *T.turgidum* (without the / q).

Established specific characters, put byK.Linney in the basis of division into species are wheat gene controlled with 1-3 and more unequivocal genes embodied in the process of natural selection of wheat cultivation. The lack of clear morphological traits and genetic barrier, the homology of genomic composition and the presence of similarities are overlapping the genetic variability in the shaping process, allow us to combine all kinds of cultural tetraploid wheat (except *T. timopheevii*) into one species, leading their descent from a common ancestor Emmer - *T. dicoccum* Shrank. Polygenic process of cultivation gradually separated from *T. dicoccum*, *T.dicoccoides*. Due to the lack of mechanisms for reproductive isolation *T.dicoccum* widely distributed around the globe and won continuous and wide ecological niches with different conditions. For a long natural evolution under the influence of environmental conditions (high mountains), and a series of independent mutations the different morphological and ecological types are differentiated, now tentatively called subspecies: durum, turgidum, persicum, polonicum, aethiopicum. It is proposed by us to include in the group tetraploidea only four types: *T.dicoccoides* Korn., *T.timopheevii* Zhuk., *T.araraticum* Jakubz., *T.dicoccum* Shubl. Resynthesis species by genetic analysis showed that many of tetraploid wheat species cannot be considered as independent taxonomic units. All other species belong to the natural ecological and geographical categories.

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