

HERITAGE WHEATS OF GEORGIA

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DOI: https://doi.org/10.31435/rsglobal_conf/30122020/7344

Abstract. Georgia is characterized by remarkable diversity of the domesticated wheat. Five out of the fourteen wheat species found in Georgia, originate from Georgia and are local endemics. These wheat species are characterized by their taxonomic identity, morphology and the role they played in the ancient agriculture of Georgia. They are also important breeding material as contain genes for local adaptation.

Keywords: Wheat, endemic, hulled wheat, free-threshing wheat, dika, zanduri, makha, asli.

Introduction. Georgia is the only country in the world, where as many as 15 species of wheat are present out of 20 recognized worldwide. Georgia is characterized by the highest diversity and endemism of ancient hulled wheats, highest diversity of free-threshing wheats, presence of all tetraploid wheats and of a special endemic *T. timopheevii* - *T. zhukovskyi* lineage of AAGG-AAGGAA genomes (Sinskaya, 1969). Archeological excavations of the ancient Neolithic farming society (Shulaveri-Shomu complex) confirmed existence of nine species of wheat in Arukhlo and eight domesticated wheat species in each of Shulaveri and Khramis Didi Gora (southeast Georgia) dated back as 8000 BP (Rusishvili, 1988). Cultivation of wheat by Georgians is mentioned in the works of Greek historians Herodotus and Xenophon (Kaukhchushvili, 1960). The names of the ancient Georgian wheats such as Zanduri, Makha and others were first mentioned in Georgian written sources as early as the 5th century AD.

***Triticum carthlicum* Nevski (Karthlian wheat).**

T. carthlicum Nevski (Karthlian wheat) has been cultivated for at least 8000 years. It is tetraploid (AABB) spring wheat with free-threshing, flinty, generally red kernels. Karthlian wheat's spike morphology resembles more the morphology of common wheat (*T. aestivum*) rather than that of other subspecies of free-threshing tetraploid wheat. Its similarity with bread wheat was confirmed through grain protein analysis. Bread produced from Karthlian wheat tastes almost as good as common wheat bread. It was widely grown on the southern slopes of the Greater Caucasus, preferably on highlands starting from 1000 m asl up to 2300 asl, where agricultural production is limited due to severity of the climate (Naskidashvili, 2013).

***Triticum macha* Dekapr. & Menabde.**

T. macha is a hulled hexaploid (AABBDD) wheat, endemic to Georgia. It is called Makha wheat in Georgia. *T. macha* is a late-maturing winter wheat with tall, hollow stems. It has brittle rachilla and spikes fall down at late stages of maturity. It was a major component of the Makha landrace, which was mainly planted in Racha-Lechkhumi, as well as in Lower Svaneti, Imereti and Samegrelo. The Makha landrace also included *T. palaeocolchicum*, a tetraploid wheat, which is described in the next section. In Makha fields, *T. macha* itself was presented in great variation for spike color (white and red) awnedness (awned, semi-awned and awnless) and hairness of glumes. The local farmers developed special tools to harvest hulled wheats. First the wheat spikes were harvested by Shnakvi, a special tool consisting of two sticks tied together and gathered in baskets. After wheat stems were cut with sickles and bundled. The bundles were used to cover the roofs of houses and barns.

***Triticum palaeocolchicum* Menabde.**

T. palaeocolchicum (Colchis emmer) is a hulled tetraploid (AABB) wheat, endemic to Georgia. It was called Colchis emmer by Georgian researchers because of its local endemism. It is

very similar to wild forms of tetraploid wheat due to its morphological characteristics. Its spikes contain up to 40 fertile spikelets. Leaves are broad. The stems are strong and tall (up to 120 cm). Its important agricultural characteristics include resistance to fungal diseases. Grains of Colchis emmer are distinguished by high protein content, and high lysine content in protein. Colchis emmer was widely spread as mixture of the Macha landrace in West Georgia. The local population did not differentiate it from Makha wheat and grain of both species were milled altogether and used to produce bread. Colchis emmer is represented by 3 varieties in Georgia (Dekaprevich, 1954).

Zanduri landrace.

The Zanduri landrace was widely distributed in West Georgia, especially in Racha and Lechkhumi (until the 1930-ies). The landrace consists of three species such as *T. monococcum* var. *hornemanni*, *T. timopheevii* and *T. zhukovskyi*. *T. monococcum* var. *hornemanni* (Gvatsa zanduris called by native Georgians) is not endemic to Georgia, as it was widely spread in other wheat planting regions as well and it is not considered in the present paper. However, *T. timopheevii* and *T. zhukovskyi* are found only in Georgia. They are characterized by G-genome. Wheats with the G-genome occurred only in Georgia. The Zanduri landrace is harvested in a similar way as Makha. The local farmers developed special tools to harvest hulled wheats. First the wheat spikes were harvested by Shnakvi, a special tool consisting of two sticks tied together and gathered in baskets. After wheat stems were cut with sickles and bundled. The bundles were used to cover the roofs of houses and barns (Menabde, 1948).

***Triticum timopheevii* (Zhuk.) Zhuk.**

T. timopheevii (Zhuk.) Zhuk (Timopheevi wheat) is called Chelta Zanduri. It is a tetraploid (AAGG) late-maturing hulled spring wheat with leaf blades that are pubescent on both sides. Spikes are very compact, rather short, somewhat pyramidal in shape with soft, thin, rather short awns. Spikelets usually contain two kernels. Kernels are medium long, slender and hard or flinty. *T. timopheevii* is known as drought and frost resistant plant. Chelta zanduri owing to its special immunity to fungal diseases deserved particular attention of wheat breeders. It was used as a source of cytoplasmic male sterility in wheat breeding. It is known by adaptation to all kinds of soils (even to limestone). The wheat stem rust resistance gene Sr36, derived from *T. timopheevi*, confers a high level of resistance against a new race (Ug99) and many other races of *Puccinia graminis* f. sp. *Tritici* (<https://www.globalrust.org/gene/sr36>). It is also a source of Cytoplasmic Male Sterility for bread wheat. Among its negative features hulled grains and difficulty in threshing should be mentioned.

***Triticum zhukovskyi* Menabde et Eritczjan**

T. zhukovskyi Menabde et Eritczjan (Zanduri) is a hexaploid (AAGGAA) late-maturing hulled spring wheat, a member of the Zanduri landrace. It was identified in the Zanduri landrace in 1959 by V. Menabde and A. Eritczjan (1960). They proposed that it should have originated through allopolyploidization of diploid gvatsa zanduri and tetraploid chelta zanduri. Farmers did not differentiate it from chelta zanduri and the hexaploid plants did not have a special common name. It is a very late maturing wheat. However, it is characterized by wide adaptation, frost and drought resistance. Bread baking quality is similar to that of Chelta zanduri.

Conclusions. The local endemic wheats of Georgia constitute heritage of the ancient Georgian agriculture and remain an integral part of the Georgian culture. They are unique as they represent different stages in wheat evolution. They have contributed in the food security of Georgia for many centuries. They are last production fields were seen in the 1930-ies. However, their importance in wheat evolution is often ignored. The endemic wheats of Georgia contain precious genes of local adaptation that can contribute into sustainability of wheat production and is important breeding material for developing improved wheat varieties adapted to the changing climate and new races of pests and pathogens. It is noteworthy to mention, their economic importance is reviving nowadays, as the artisan bakeries apply these wheats in bread baking.

Acknowledgements.

This work was supported by Shota Rustaveli National Science Foundation of Georgia (SRNSF) Grant Number FR 17_566.

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