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# Diversity and local use of wheat in Georgia

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A B S T R A C T

Georgia is characterized by remarkable diversity of wheat and an important tradition of wheat production, which have left significant mark on the local language, production practices, culture and everyday life of the local population. The Racha-Lechkhumi province in western Georgia was a refuge of hulled wheat species of makha and zanduri. Naked tetraploid dika and hexaploid bread wheat were major wheat species cultivated in the east and south of Georgia. The harvest practices differed between hulled and naked grain wheats. Some of the hulled wheat spikes are brittle and must be harvested first to avoid shattering. After cutting off heads, the spikes were thrashed and hulled grain was de-husked before milling. Stems were harvested separately. Naked-grain wheats were harvested in bundles at once and thrashed with special sleds on flat yards. The major types of ovens in Georgia were tóné and pourne. In tóné, the pieces of dough are stuck on the hot walls, while in pourne, dough is baked on flat stones. Both naked and hulled wheat grain produced flour of sufficient gluten quality to stick on the walls. The major types of bread are Georgian lavashi and shoti. The Georgian lavashi is very different from the Asian lavahs. The Georgian lavashi is round, relatively thick and is baked in tóné, while the Asian lavash is very thin and baked on flat stones. Other type of local breads like somini and Meskhuri lavashi were spread in South Georgia. Various meals are produced from wheat flour and dough in Georgia. Wheat flour was widely used in folk medicine to treat wounds, diarrhea, stomatitis, while sprouted wheat was used to support people with broken health. The chaff of wheat is fed to livestock. Wheat bundles were used to cover the roofs of houses and barns in rural areas until the middle of the 20th century.

***Keywords:*** Wheat, Hulled, Naked-gain, Use, Bread, Production practice.

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## Introduction

To this day, the South Caucasus region, especially Georgia, is renowned for its delicious ancient wheat species that are almost unknown to the rest of the world. It is largely overlooked by wheat researchers that Georgia is one of the main centers of wheat origin and the most important center of wheat diversity in the world. The archeological excavations of Neolithic sites suggest that population of Ancient Georgia began cultivation of wheat 8000 years ago [1, 2]. Cultivation of wheat by Georgians is mentioned in the works of Greek historians Herodotus and Xenophon [3, 4]. The names of the wheats 'Ipkli' 'Dika' and 'Asli' were first mentioned in Georgian written sources as early as the 5th century AD.

Wheat production and use have left significant impact on the local language, production practices and everyday life of the local population. The role of bread, wheat grain and flour in local diets is very

high. Georgia is among the top ten countries in terms of consumption of wheat per capita. Although wheat is not a big crop in modern Georgia, its histori- cal role for local agriculture and impact on the culture of the local dwellers cannot be overestimated.

## The diversity of wheat in Georgia

Georgia is the only country in the world, where 15 out of 20 wheat species recognized worldwide of wheat are present: *Triticum boeoticum* Boiss., *T. monococcum* L., *T. dicoccum* (Shrank) Schübl., *T. palaeocolchicum* Menabde, *T. timopheevii* (Zhuk.) Zhuk., *T. durum* Desf., *T. turgidum* L., *T. carthlicum* Nevski, *T. macha* Dekapr. & Menabde, *T. zhukovskyi* Menabde & Ericzjan, *T. turanicum* Jacubz., *T. polonicum* L., *T. spelta* L., *T. compactum* Host, and *T. aestivum* L. Five species (*T. timopheevii, T. zhukovskyi, T. macha, T. palaeocolchicum, T. carthlicum*) are endemics to Georgia [5]. Out of the 15 wheat species represented in Georgia, 8 are hulled, and 7 are naked (free-trashing). All endemic species except *T. carthlicum* are hulled. Georgia is distinguished by the highest number of tetraploid wheat species.

Wheat species: *T. macha, T. palaeocolchicum, T. compactum* and *T. spelta* as well as some forms of *T. dicoccum* and varieties of *T. aestivum* have a vernalization requirement and belong to winter wheats (are sown in the fall). *T. monococcum, T. timopheevii, T. zhukovskyi, T. durum, T. turgidum, T. carthlicum* and some varieties of *T. aestivum* do not have a vernalization requirement and are characterized by spring growth habit. Winter is mild in Georgia and most of the spring wheats often produce reasonable yields when sown in the fall.

## Hulled wheats

The tough glumes of hulled wheats give excellent protection to the crop in the field and in storage. These wheats are also resistant to poor soil conditions and a range of fungal diseases [6]. Although the share of the hulled wheats decreased even more over the centuries in Georgia, the West of the country (predominantly Province of Lechkhumi) still represented a repository of hulled wheats by the first half of the 20$^{th}$ century as evidenced by many researchers. Two major hulled wheat landraces, Zanduri and Makha were widely produced there.

**Fig. 1.** *T. timopheevii (chelta zanduri) in the living collections of the Institute of Botany and Georgian National Botanical Garden (Photo of I. Maisaia)*

Zanduri landrace consists of three species: *T. monococcum* var. *hornemanii* (gvatsa [narrow] zanduri), *T. timopheevii* (chelta [wide] zanduri) and *T. zhukovskyi* (zanduri). Gvatsa zanduri is not endemic to Georgia, as it was widely spread in other wheat producing regions as well and it is not considered in the present paper. However, chelta zanduri and hexaploid zanduri are endemics and found only in Georgia. Zanduri landrace was sown in Lechkhumi and Racha until 1960-ies.

The makha landrace is composed of *T. macha*, a hulled hexaploid (AABBDD) and *T. palaeocolchicum* (Colchis emmer) a hulled tetraploid (AABB) wheat, both are endemics to Georgia. *T. palaeocolchicum* was first described in Lechkhumi by V. Supatashvili in 1929 [7].

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 most widespread form was white spike with short awns and without hairs. Fourteen varieties of Makha have been identified by Georgian researchers Dekaprelevich and Menabde in 1932 [8, 9].

## Naked (free-thrashing) wheats

Among the naked wheats, Kartlian (east Georgian), not “Persian” [9] wheat - *T. carthlicum* (tetraploid) and bread wheat - *T. aestivum* (hexaploid) had the most remarkable economic significance in

Georgia, which grew over the centuries. Both *T. carthlicum* (local name Dika) and *T. aestivum* (under the old name Ipkli) were mentioned in the written sources of the 5th century AD together with the hulled wheats [4]. They occupied much larger areas than hulled wheats and were cultivated in various environments, mostly in the Samtske-Javakheti Region (South Georgia) and Kakheti (East Georgia). Dika was produced predominantly in the mountains, while bread wheat production was confined with the lowland areas.

*Triticum carthlicum* - Dika ranks second to *T. aestivum* according to its distribution and significance for the Georgian agriculture. Typically, Dika (Fig. 1) was produced in the highlands of Georgia, within 1000-2000 m asl. However, some its fields were spread as low as 750 asl and as high as 2300 m asl. Dika is characterized by great intraspecific diversity, which allowed to identify eleven varieties. However only three of them covered significant areas. Black dika, with black glumes (*T. carthlicum* var. *fulliginosum* Zhuk.) was distributed across the Great Caucasus Range forest belt (900-1400 m asl) [10]. Red dika (T. *carthlicum* var. *rubiginosum* Zhuk.) dominated in more drought-prone areas of Samtskhe-Javakheti, Trialeti, Kartli, Pshav-Khevsureti, Mtiuleti, Tusheti, Imereti, Racha-Lechkhumi, and Svaneti. White dika (var. *stramineum* Zhuk.) is found as a mixture in bread wheat fields of Trialeti, within the Rioni, Liakhvi, Enguri, and Kvirila river valleys (Fig. 2).

Although dika and bread wheat production areas did not overlap, dika was often mixed with bread wheat. Farmers were not able to maintain purity of the fields because dika is strikingly morphologically similar to bread wheat (*T. aestivum*). However, mixture of bread wheat grain provides for better bread baking quality of the flour and is beneficial for farmers. E.g. the most widely spread wheat landrace in Samtskhe-Javakheti Region was called Javakhetian dika, which was a combination of Red dika with a spring soft [11-13].

Dika-barley mixtures were also widespread in the cold areas. In the mixed plantings two layers are formed in the grass stand, as barley is much shorter than dika. Such stands can be sown with higher density as competition between plants of the different species is alleviated because of the layer differentiation. The bread baked from the flour of this mixed crop outperformed in quality the barley bread.

**Fig. 2.** *Dika field near village Tsnisi, Meskheti (Photo of M. Mosulishvili)*

Dika mixed with rye was also widespread in the mountain areas of Georgia. It is not surprising as wild rye is a widely spread weed in the wheat fields in Georgia. In this case, two-layer stands were also formed as rye is significantly higher than dika. The bread produced from the mixture of dika and rye had a specific flavor, which was praised for good taste by the local population of the western Georgian provinces of Racha and Lechkhumi.

Bread wheat - *T. aestivum* (local name Doli, Dolis-puri) was cultivated in every locality of Georgia, which had at least minimal environmental conditions for wheat cultivation. This was possible due to the large diversity of the species including a large number of botanical forms demonstrating different growth habits (winter, spring and facultative varieties) and adaptation to different abiotic and biotic stresses.

**Fig. 3.** *Meskhuri doli field near village Tchobareti, Meskheti (Photo of M. Mosulishvili)*

However, the most widespread bread wheat variety was tsiteli [red] doli (*T. aestivum* var. *ferrugineum*). The diverse ecological conditions of Georgia made it possible to develop several ecotypes within doli, which formed the following three major local landraces: Meskhuri Tsiteli [red] Doli, Kakhuri Doli, and Svanuri Doli. They developed under completely different ecological conditions of the provinces of Meskheti, Kakheti and Svaneti, respectively (Fig. 4). These landraces are noted for their prolific tillering ability, yield stability, resistance to shattering and some diseases. Georgian Red Doli is produced as a heritage wheat in southern France and is known there as 'the Caucasus Rouge' [13].

## Wheat harvest

Naked grain wheat plants were harvested in bundles and threshed on a flat yard called Kalo (Fig. 4) using a special tool - threshing sled (local name Kevri, Fig. 5), a flat wooden board with stone teeth on the lower side. When the naked species are threshed, the glumes and chaff break and the grains are immediately released. Kalóóba, the day of wheat thrashing was an important event celebrated by local people. This celebration is revived in modern Georgia.

**Fig. 4.** *Kakhuri doli field near town Dedophlis-Tskaro (Photo of M. Mosulishvili)*

Wheat grain was milled on water mills. Large round stone, which was used for grinding of wheat grain was called 'dolabi'. The used-up surface of the dolabi was regularly up-graded using a cavil to improve cohesion with grain, which provided for well-grinded flour. This work was called 'mokhodva'. When a new or up-graded dolabi was installed for the first time, the initial portion of flour was discarded as it could contain small stones or mild rocks removed by cavil.

**Fig. 5.** *Kalóóba*

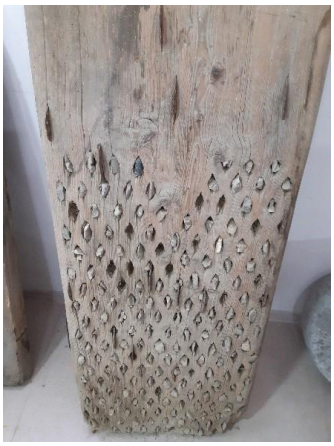
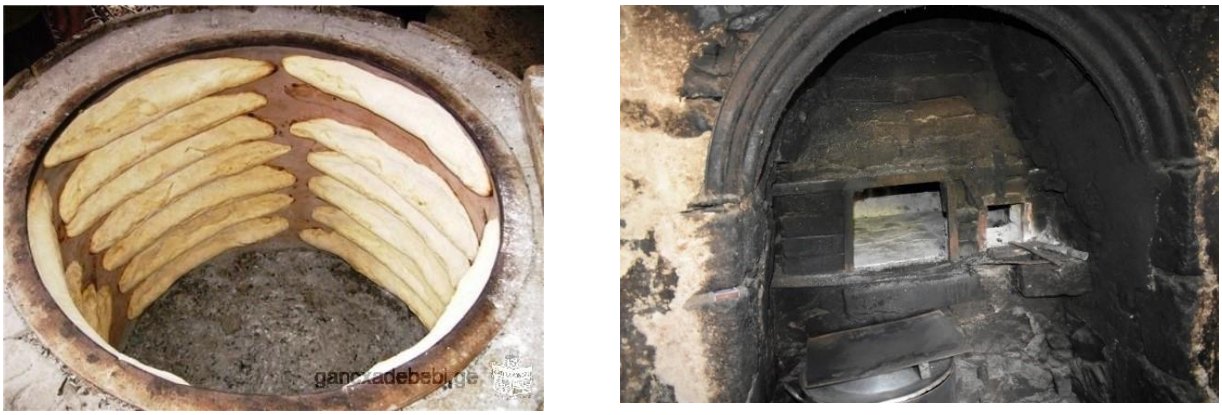


**Fig. 6.** *Kevri thrashing sled (Photo of G. Chkhutiashvili)*

In case of the hulled wheats, because their spikes were brittle, the local population harvested spikes on the first place to avoid shattering using a special tool Shnakvi. It consisted of two sticks, which were tied together [4]. The wheat spikes were gathered in baskets and taken from the field separately from stems. As thrashing was not sufficient to liberate grain from chaff, the grain was further dehusked by pounding before milling. However hulled seed was used for seeding. After the harvest of the spikes was finished, wheat stems were cut with sickles and bundled. A similar approach was used in areas where spelt wheat was produced in Spine [14].

## Uses in food

Georgian bread was mostly baked in two kinds of the oven: tóné and pourne (Fig. 7). Tóné is a bottomless cylindrical clay construction, embedded in soil, of about 1 m height. Bread is stuck on the hot walls in tóné, which is heated by burning firewood on the soil (Fig. 7a). Pourne is constructed from stones and looks more similar to house ovens (Fig. 7b), where bread is arranged on flat stones, which are heated with burning wood.



a) b)

**Fig. 7.** *Traditional ovens in Georgia: a) tóné (Photo of Nino Ustiahsvili) and b) pourne (Photo of M. Mosulishvili)*

It is important that dough easily to sticks to the hot walls, doesn't not fall off and burn while baking for baking bread in tóné. The local varieties of bread wheat, as well as other wheat species of dika, makha and zanduri, which are discussed in this paper, are suitable for baking of bread in tóné as have a sufficient gluten content and gluten viscosity. Hulled wheat Makha's bread was considered as of high quality among the local population of Racha-Lechkhumi. Makha bread is white, tasty and flavorful, not to mention its ability to remain soft for several days. It was honor to treat guests to 'makha' bread at feasts.

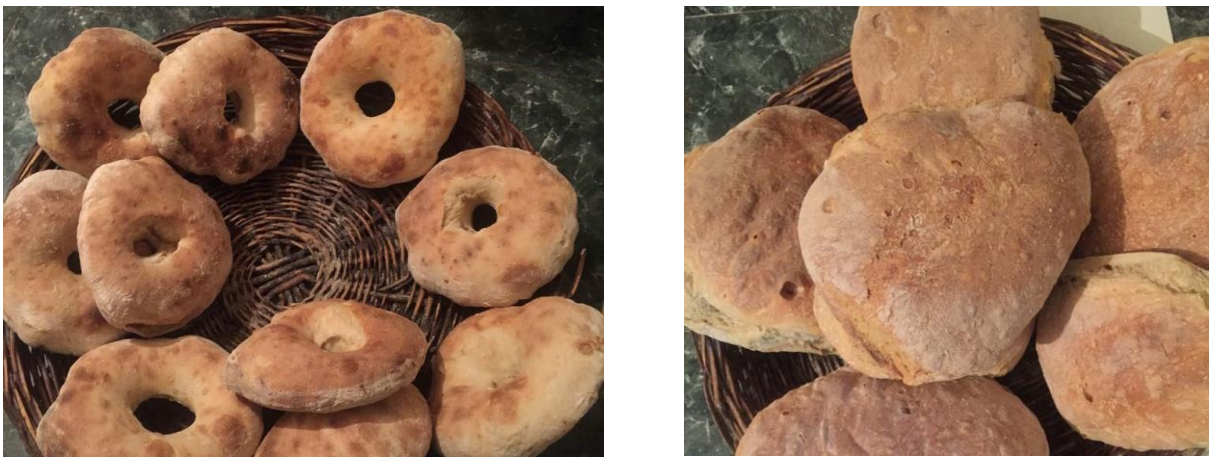
Bread with different forms are baked in Georgia (Fig 8). The major local wheat types include Georgian lavashi and Kakhuri [Kakhetian, east Georgian] shoti. Georgian lavashi is very different from the Asian lavash. The Asian lavash is widely spread in Iran, Armenia, Azerbaijan, Central Asia. It looks like thin sheet. It is produced from very flat, well-rolled unleavened dough, which is baked on 'saj' – a flat round or square stone or metal pans heated by firewood inside the traditional ovens or outside them. The Georgian lavashi is much thicker and it has a round shape. Unlike to the Asian lavash, the Georgian lavashi can be baked stuck to the walls of tóné. The major difference of shoti from Georgian lavashi is in its form. Kaketian shoti has a prolonged, sometimes arced shape with sharped ends (see Fig. 8b).

a) b) c)

**Fig. 8.** *Examples of Georgian bread: a) Georgian lavashi and b) Kakhetian shoti and c) somini (Photos of N. Ustiashvili and L. Meskhi)*

Yeast is not applied directly in the traditional breads, but some amount of the old sour dough is retained and mixed in the new dough for leavening. Mixed dough is left for a night before baking to achieve good level of leavening.

According to Jalabadze *et al.* bread was a staple food in Meskheti and Javakheti (South Georgia) [15]. It was baked in pourne. Meskhuri [Meskhetian] bread produced from doli wheat was widely spread in the region. However, the local population also differentiated bread produced from dika, which was called Makhnia bread. This bread was mainly produced in the villages located in the uplands of the river Mtkvari basin [16].



a) b)

**Fig. 9.** *Meskhuri [Meskhetian] breads: a) podola and b) somini (Courtesy of L. Meskhi)*

Local bread in Meskheti is often baked in the form of 'podola' (round flat bread with a whole in the center; named also Meskhetian bread) and 'somini' (big spherical) breads (Fig. 9), 'kakala' (small spherical) bread were also widespread.

Various meals are produced from wheat flour and dough in Georgia [17]:

**Tatarbega** - dough is cut in small pieces of the form of butterfly, which is boiled in salted water and is seasoned with matsoni (Georgian sour yoghurt - fermented milk of local production), garlic and pan-fried onion.

**Katmari** – five layers of dough filled with ghee between the layers and spliced edges baked in an oven.

**Lukhumi** – walnut-size balls produced through mixing flour with milk and frying these balls in ghee on a pan.

**Sironi** – thin dough is rolled over a wooden stick (called 'ukhlavi'), cut in circles, baked in an oven, fried on a pan and dipped with ghee and matsoni. After boiling it is kept in warm temperature for a short time before serving (Fig. 10).

**Fig. 10.** *South Georgian [Meskhetian] meal sironi (Authors: Sh. Vanadze and E. Poladishvili Source*: https://mtianiachara.wordpress.com/2015/11/ in Georgian)

**Erishta** –long and narrow pieces of dough, dried in pourne, are rinsed in boiling water and dipped in ghee and matsoni.

**Makarlama** – boiled pieces of dough are seasoned with pan-fried onion and shredded cheese.

**Khavitsi** – mixture of flour with water, milk and ghee is boiled on light fire until it gets consistency of thick creamy soup.

**Korkoti (kolio)** – boiled grain mixed with milk, honey and walnuts. Meal, which is used in rituals organized for remembrance of someone who passed away.

**Kumeli** – roasted flour, sometimes mixture of wheat and barley.

## Uses in folk medicine and other uses

Wheat has been widely used in folk medicine in Georgia. Wheat flour was a component of many ointments. Khavitsi (mentioned as meal in the previous section) was used to drain pus from wounds. Wheat grain broth was mixed with alum and used mouth rinse to treat stomatitis. Wheat starch was used to control diarrhea. Meals cooked with sprouted wheat seed was used to strengthen people with broken health or pregnant women. Local people also used to drink a decoction of Makha grains to improve eyesight [12].

Chaff of wheat is fed to livestock. Wheat bundles were used to cover the roofs of houses and barns [18]. In the province of Lechkhumi, the small houses and farm buildings were covered with “Koroli” the clustered stalks of Zanduri [4].

## Conclusion

Georgia is a country of ancient agriculture, characterized with outstanding diversity of wheat species. These species represent different directions and stages of wheat evolution and suggest that the population of Georgia was involved in wheat domestication. These involvement is reflected in diverse production practices, heavy use in local cuisine and folk medicine. Wheat has become an integral part of the local culture.

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