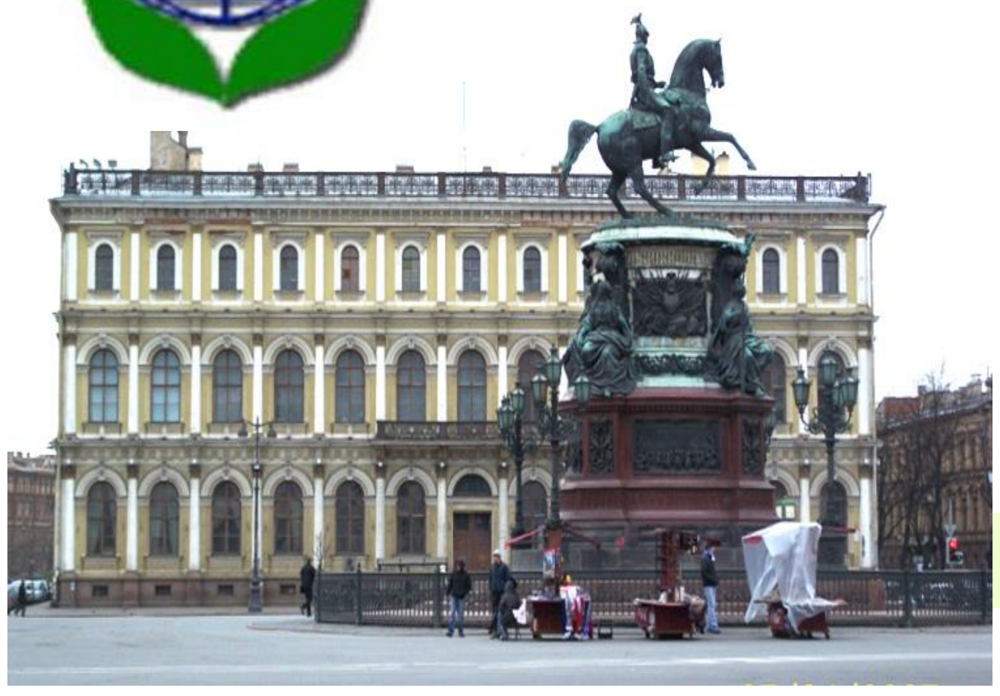

Avenins as markers in oat breeding and seedproduction

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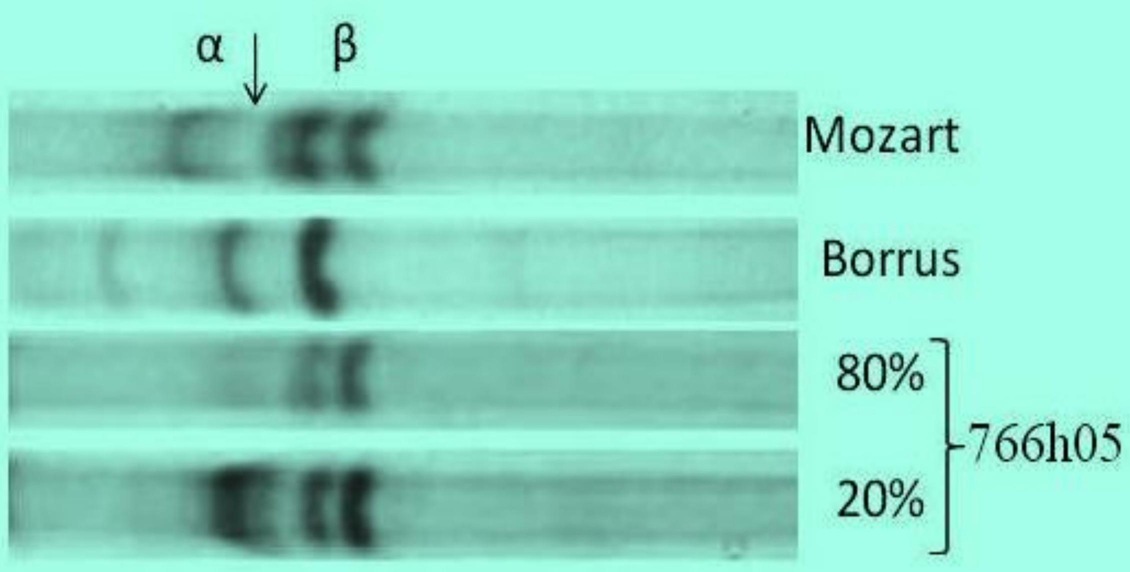
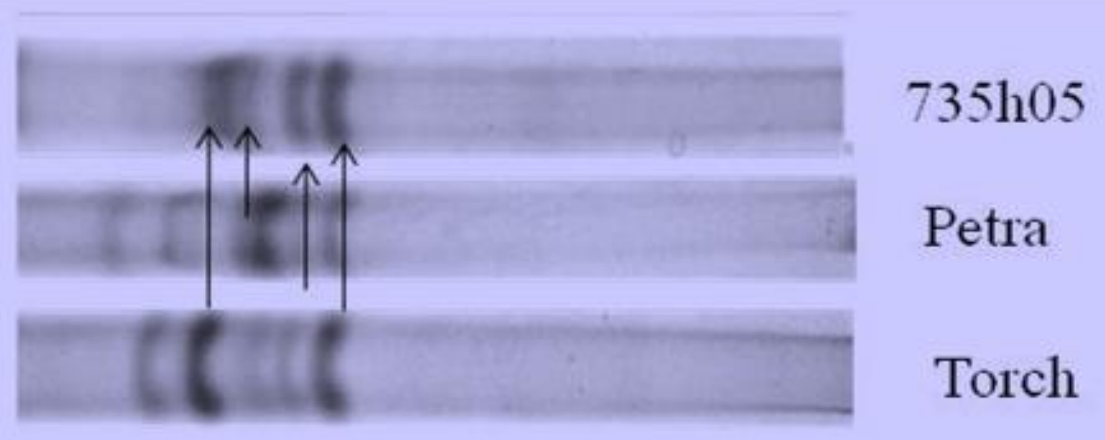
Grains of all cereals contain storage proteins (prolamines) such as wheat gliadines, barley hordeines, rye secalines, etc. The oat prolamine is avenine consisting of two fractions –α- and β-avenines. Both fractions are heterogenic and polymorphic. Electrophoresis reveals from 2 to 8 components in them. It is known that the component composition of avenine is variety-specific and can be used successfully for oat cultivar identification and registration.

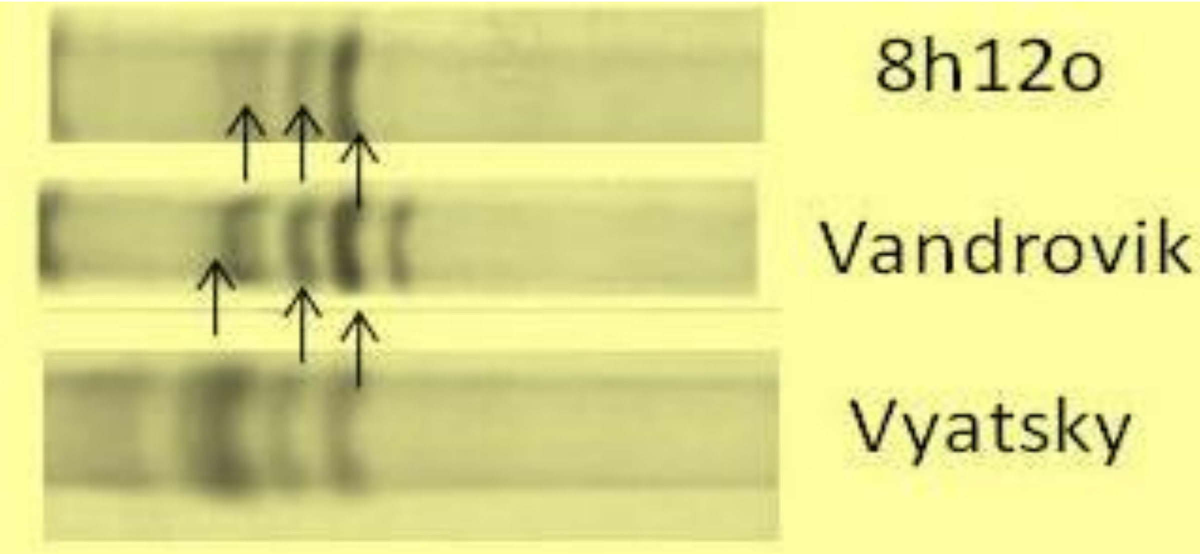
Much less information is available on the nature of inheritance of avenin components in breeding process. **Our task is to compare the component composition of avenins in new cultivars and lines of naked oats with their parental forms.**



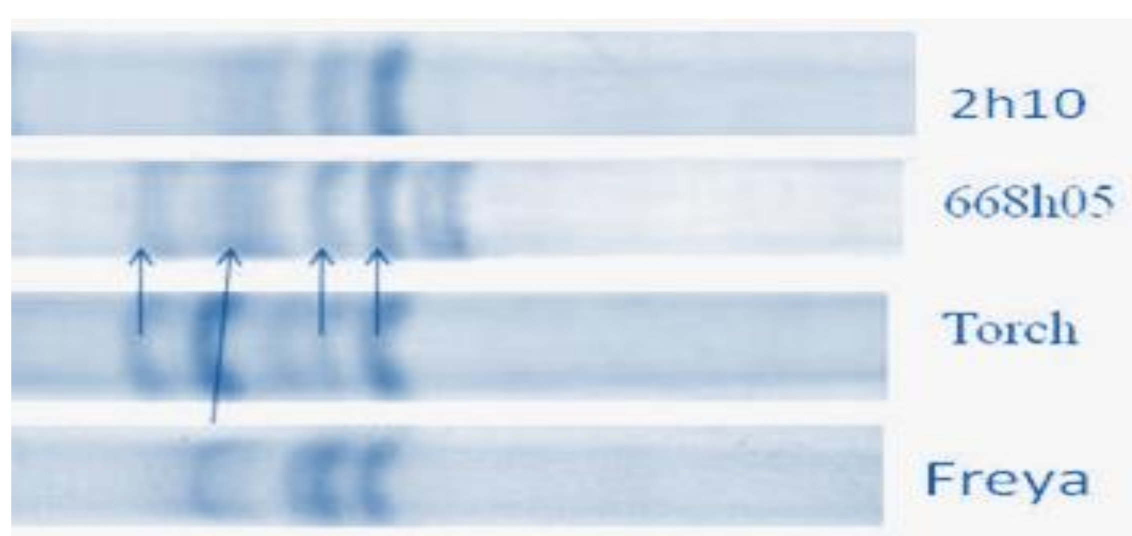
Selection for grain nakedness and valuable agricultural traits from the hybrid population produced by crossing **Borrus × Mozart** resulted in the development of the line **766h05.** It consists of two biotypes differing in avenin patterns. Both biotypes include components of the parental cultivars in different combinations. The prevalent biotype (80%) is interesting for the lack of the α-avenin



The line **735h05** obtained from F_3 of the cross **Petra × Torch** is homogenic and has one avenin pattern including mainly β-avenines.



Selected fromF_3 of the cross **Vandrovik × Vyatsky** was a homogenic line with avenin composition similar to cultivar Vyatsky.



In the line obtained from the backcross **Vyatsky × Vandrovik** three different avenin patterns were observed. All three contained differently combined avenins of the parental cultivars.

Two lines were selected from the hybrid combination **Torch × Freya**: 2h10 and 668h05. In its avenin composition the line 2h10 is close to cultivar Freya, while 668h05 to cultivar Torch. In β-avenin of the latter line there is a component absent in the avenins of both parental cultivars.

A morphologically homogenic population with 3 different avenin patterns was obtained from the reverse combination **FreyaxTorch**. Thirty per cent of this population has avenin patterns identical to the avenin of the line 2h10 from the cross **Torch × Freya.** One of the biotypes, similar to the line 668h05, comprises the β-avenin component which is absent in the avenins of both parental cultivars. This component is typical for cultivar **Tyumensky Golozerny**. The appearance of this β-avenin component in several lines may probably be explained by the involvement of the hybrid (Torch × Freya) ×Tyumensky Golozernyin one of the stages of the breeding process.

Two stable lines 7h120 and 3h10 were selected from $F_3$of the cross (**Torch × Petra)× Tyumensky Golozerny** for their grain nakedness and adaptability. Avenins of both lines comprised all components of the parental cultivars. Only one avenin pattern type was observed in the line 7h120, while the line 3h10 had two types of avenin pattern. One of them is identical to the avenin pattern of the line 7h120 (30% of the population); avenins of the other 70% differ in their composition.

A promising F_4 line was selected from the hybrid population obtained by crossing the covered cultivar **Faust** with the French naked cultivar **Nuprime** in 2004. In 2015, it was submitted to the State Variety Trials as the cultivar **Bekas**. Avenins of 90% grains of this cultivar include intensive β-avenins and very weak α-avenins. On the contrary, in 10% α-avenins prevail.

Thus, cultivars and lines involved in breeding programmes differ in the composition of avenin components and can be identified by avenin electrophoresis techniques. More than half of the cultivars and lines studied are homogenic in their avenin patterns. The rest consist of two or three biotypes differing in avenin composition. In morphologically uniform populations with several avenin patterns, latent variability in stress resistance may be present. The same hybrid combinations, depending on the direction of crossing and the method of selection, produced lines differing in their avenins. It means that avenins are useful as markers when parental components for crosses are selected and for making the breeding process more efficient.

Recently, a new trend has taken shape in oat breeding. It is associated with the search for oats without grain proteins toxic for patients with celiac disease. In this context, the most interesting is the composition of α-avenins. Their molecules have many disulphide bonds and are resistant to proteolysis. It is in these molecules that many peptides toxic for celiac patients have been found. In this respect, oat lines with low content of α-avenins or without them are very promising for producing functional food for celiac diets. Among the studied breeding forms of oat, prevalent biotypes from the line 766h05 and cultivar Bekas are of interest. Thus, electrophoresis of avenins combined with ELISA may prove useful for the development of oat cultivars required for producing functional foods for celiac diets.