

Genetics and Selection

“Gorda”- a New Short-Stemmed Botanical and Genetic Variety of Soft Wheat (*Triticum aestivum* L.) Obtained by Induced Mutagenesis

Petre Naskidashvili*, Gulnari Chkhutiashvili, David Bedoshvili **, Maka Naskidashvili****

* Academy Member; Georgian Agrarian Academy, Tbilisi

** I. Lomouri Institute of Agriculture of the State Agrarian University of Georgia, Tserovani

ABSTRACT. Short-stemmed super dwarf wheat “Gorda” is obtained via treating seeds of the French-bred winter variety “Ducat” (released for distribution in Georgia) by 0.01% solution of chemical mutagene NMU – nitrosomethylurea. “Gorda” is a mutant form of winter wheat. The plant is bunch forming with reduced numbers and lengths of internodes and its maximal height is 26-27 cm. The leaves are broad and erect. The stems are short, firm and they hardly bend. The spikes are awnless, short (4-5 cm), flat and dense, in which grown underdeveloped florets are densely arranged on the spike rachis. The glumes of the spikelet are convex. “Gorda” is a late variety for as many as 10-12 days as compared to the regular local check varieties. It is susceptible to leaf rust and powdery mildew. Grain is shriveled and therefore the mass of its thousand kernels does not exceed 30 g. Grain raw gluten content is about 27-28%. “Gorda” represents breeding material of new inheriting property, which can be used as initial material for developing short-stemmed varieties with 2-3 height reducing genes. © 2012 Bull. Georg. Natl. Acad. Sci.

Key words: induced mutation, mutant, short-stemmed plant.

Cultivated species of wheat (*Triticum* L.) underwent significant modifications outside the genetic centre or their origin as a result of domestication, but complete reconstruction of plants of each species (variety) was performed by means of natural and artificial, close and remote hybridization of different varieties, sorts, forms and landraces, via possible recombination, interaction of characters of paternal forms and also by means of induced mutagenesis.

The idea of reducing the stem length of soft wheat (*T. aestivum* L.) was first proposed by the famous Italian breeder Nazareno Strampelli nearly 80 years ago [1]. His contribution to this objective is enormous and the first commonly accepted short-stemmed

selection variety of soft wheat (“Ardito” as well as others) was developed by him.

The problem of obtaining short-stemmed and comparatively early sorts of soft wheat was solved by N. Strampelli by crossing Italian and West European high stemmed sorts with Japanese short-stemmed and early sorts. Further significant scientific and practical results in this direction were achieved in Japan, Argentina, Canada, Mexico, as well as in Georgia and its neighbouring countries [2-5].

Versatile scientific investigations and practice have proven that potential capacity for increasing the grain yield of wheat is to a great extent dependent on the reduction of stem height and obtaining

the corresponding short-stemmed varieties.

Scientific investigations and practice clearly demonstrate that 70-90 cm should be assumed as the most favourable height for wheat species. Such height of stem provides not only resistance of a plantation to lodging but also efficient kernel formation.

In parallel to developing short-stemmed wheat species by the method of hybridization plant selection practice successfully applies the method of induced mutagenesis. Hundreds of initial selection materials of cereals, legumes, melons and gourds, technical, forage, vegetable, ornamental and other crops have been obtained by means of affecting seeds and plants with physical and chemical mutagens. On the basis of this material many varieties and hybrids checked (approved) for distribution have been obtained and their number increases annually.

Applying the methods of hybridization and induced mutagenesis, Georgian breeders (L. Dekaprevich, M. Sikharulidze, E. Chernysh, P. Naskidashvili, S. Tedoradze, O. Liparteliani, G. Khutsishvili, Z. Jincharadze, G. Chkhutiashvili, A. Mdivani, N. Rusitashvili, V. Sukhishvili, I. Saatashvili, A. Makharoblidze, and others) have developed donor varieties which bear valuable economic and biological features and obtained sorts and hybrids which are approved for distribution.

The present work deals with breeding and research of super-dwarf “Gorda” – a completely new donor cultivar, genetic source for breeding of intensive type wheat, winter, spring and facultative wheat cultivars, which can be sown in two terms.

Initial material and methods. Intensive type French-bred variety of winter soft wheat “Ducat” has been chosen as initial material for obtaining the mutant by means of induced mutagenesis. Initial seed material was provided by the germplasm depository of the Department of Genetics and Selection of the I. Lomouri Institute of Farming. Seeds of the mentioned variety were treated with the 0.01% solution of NMU - nitros methyl urea. Seed treatment with the mutagen, sowing, care for the planted site, monitoring of the plot, plant scoring and harvesting were performed according to the commonly accepted methods.



Fig. 1. Super dwarf plant.

Results and discussion. Study of mutants revealed in M_1 has shown that it is constant and sharply differs by features from the initial variety “Ducat”; it retained only the vegetation pattern – it is winter sowing and even by this character is late for as many as 10-12 days as compared to the initial variety.

Super dwarf form “Gorda”, obtained via treating seeds of approved for distribution in Georgia French-bred variety of winter soft wheat “Ducat” with 0.01% solution of NMU represents a completely new variety of soft wheat and it was named as “var. Dekaprevichi” (Naskidashvili) in honor of Leonid Dekaprevich - the founder of genetic and selection studies in the Caucasus.

Plant of the super dwarf “Gorda” is bunch forming (Fig. 1), half-prostrate. Number of internodes is 3-4, with sharply reduced lengths of internodes.

Plant stem is very short, its maximum height attains 21-27 cm. Stem cross-cut (between the spike basis and upper stem node) is filled in with parenchyma, firm and hard bending (Fig. 2). Leaf is wide, erect. Heading (ear forming) time (emergence of the first ears in 50% of plants) occurs as many as 10-12 days later as compared with initial and regular checked varieties. Spike (ear) is short (4-5 cm), strongly dense and compact, of light straw colour, without awn and awn-like appendix (Fig. 3). Spike lower glume arm (in the middle third of the spike) is wide. Lower spikelet glume (in the middle third of the spike) is convex. Tooth of the lower spikelet glume (in the middle third of the spike) is moderately bent.

Kernel is white, shriveled, mass of 1000 kernels makes 30 g (Fig. 4, 5). Content of gluten in the kernel is 27-28%, being by 10-12% higher than in the initial variety.



Fig. 2. Plant stem and spike



Fig. 3. Spike



Fig. 4. Spike rachis and spikelet



Fig. 5. Spikelet, glume and grains (kernels)

Thus “Gorda” represents a new genetic source, new initial material for breeding, donor-variety for obtaining low height varieties with 2-3 stem reducing genes. Information on the new cultivar of soft wheat unknown to science – the Dekaprevichichi (Naskidashvili) is being published for the first time. Below is given a brief description of a new variety: var. Dekaprevichichi (Naskidashvili), var. nova is late winter variety of wheat, bunch-forming, short-stemmed (10-12 cm). Leaves wide, erect, without villi. Spike short (4-5 cm), flat, awnless. Spikelets without villi. Kernel white, corneous in consistence. The cultivar has been developed at the I. Lomouri Institute of Farming by means of treating seeds of French bred variety of winter soft wheat “Ducat” with 0.01% solution of NMM (authors: G. Chkhutiashvili, G. Khutsishvili, P. Naskidashvili, N. Japaridze, N. Sokhashvili). var. *Dekaprevichichi* (Naskidashvili), var. nova. *planta est Triticum autumnale serotinum typo frutex, stipula brevis (10-12 cm). habet folia lata verticalia*

sine villis. spica brevis (4-5 cm) plana sine arista. spicula sine villis. granum album consistentia cornuosa. prodicitur in instituto explorationis scientificae agriculturae Georgiae. admittitur pro semente segetis per praeparationem granum speciei gallici (francesi).

Conclusions

1. Obtaining of a completely new super dwarf wheat variety “Gorda” as a result of treatment with 0.01% solution of NMU of seeds of French bred variety of winter soft wheat “Ducat”, approved for distribution in Georgia, proves again the significance for the process of emergence of new forms of induced mutations together with spontaneous hybridization, which provide rich material for artificial and natural selection.

2. Super dwarf wheat variety “Gorda” developed by means of application of the chemical mutagen is an important achievement in terms of breeding varieties resistant to lodging for irrigated agriculture.

გენეტიკა და სელექცია

რბილი ხორბლის (*T. aestivum* L.) ინდუცირებული მუტაგენებით მიღებული მოკლედეროიანი ახალი ბოტანიკური და გენეტიკური ფორმა „გორდა“

პ. ნასყიდაშვილი*, გ. ჩხუტიაშვილი, დ. ბედოშვილი**, მ. ნასყიდაშვილი****

* აკადემიის წევრი; საქართველოს აგრარული აკადემია, თბილისი

** საქართველოს აგრარული უნივერსიტეტის ი. ლომოურის მიწათმოქმედების ინსტიტუტი, წეროვანი

მოკლედეროიანი სუპერჯუჯა „გორდა“ მიღებულია საქართველოში გასავრცელებლად დაშვებული ფრანგული სელექციის, საშემოდგომო რბილი ხორბლის ჯიშ „დუკატი“-ს თესლზე ქიმიური მუტაგენის NMU 0,01%-იანი ხსნარის ზემოქმედებით.

„გორდა“ საშემოდგომო რბილი ხორბლის მუტანტური ფორმაა. მცენარე არის ბუჩქის ტიპის, მკვეთრად შემცირებული მუხლთშორისების სიგრძით, რომლის მაქსიმალური სიმაღლე შეადგენს 26-27 სმ. ფოთოლი ფართო, ვერტიკალურად მდგომი; დერო მოკლე, მტკიცე, ძნელად იღუნება. თავთავი უფხო, მოკლე (4-5 სმ), ბრტყელი, მკვეთრად მკერივი, რომელშიც გაზრდილი განუვითარებელი თავთუნების რაოდენობა მჭიდროდ განლაგებულია თავთავის დერაკზე, თავთუნების კიდეები გამოპერილია. ჯიშში „გორდა“ 10-12 დღით საგვიანოა სტანდარტულ ჯიშებთან შედარებით. მარცვალი ბჟირია, რის გამოც 1000 მარცვლის მასა შეადგენს 30 გ. მარცვლის ნედლი პროტეინის შემცველობა შეადგენს 27-28%.

„გორდა“ არის ახალი მემკვიდრეობის მქონე სასელექციო საწყისი მასალა სელექციური მოკლედეროიანი (2-3 გენით) ჯიშების გამოსაყვანად.

REFERENCES

1. L.L. Dekaprelevisch (1929) Sluchai vozniknoveniia mutatsii sredi chistoi linii pshenitsy. Zapiski Nauchno-Prikladnykh Otdelov Tiflisskogo Botanicheskogo Sada. Iss. VI, Ed. L.L. Dekaprelevisch, Tiflis (in Russian).
2. N. Strampelli (1932), Origini, sviluppi, lavori e risultati. Roma (in Italian).
3. G. Inazuka (1971), Norin, a Japanese semi-dwarf wheat variety. WIS, 32.
4. N.E. Borlaug (1958), Acad. Sci. Trans., 20: 278, NY.
5. P.P. Lukyanenko (1965), Agrobiologiya, 163, 2, (in Russian).
6. S. Boroevich (1979), Genetika, IX, 11: 15-25, November, Moscow (in Russian).
7. P. Naskidashvili, M. Sikharulidze, E. Chernysh (1983), Khorblis selektsia sakartveloshi [Selection of wheat in Georgia]. Tbilisi, 340 p. (in Georgian).

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