

Variability Parameters of Strigunovsky Local Variety of Bulb Onion

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Abstract—The results of selection work for restoring the varietal qualities of Strigunovsky local varieties of bulb onion. 7 promising lines of onions with stable varietal qualities, such as the shape and color of the bulbs, the yield of bulbs and seed productivity were obtained.

Keywords—bulb onion, mother bulb, typicality, form index, seed productivity, bulb productivity, variability of varietal features

I. INTRODUCTION

Onion is one of the ancient vegetable crops cultivated by human. The center of varieties origin of bulb onion according to the theory of N. I. Vavilova is the Mediterranean, where local onions varieties were bred by popular selection methods and mass improving selection. They include the local bulb onion Strigunovsky variety, which history according to the annalistic data began more than 400 years. Settlers of the village began to grow it in the XVIII century. This bulb onion was sold not only at local markets, but also at all southern cities of the Russian Empire and part of it was sold even at world markets [1].

The local Strigunovsky variety of bulb onion was bred in a specific cultivation area under various climatic and soil conditions, which adapted them for centuries. Moreover depending on the cultivation methods and conditions the bulb onion morphological characteristics have been changed significantly especially the bulb shape. According to V. M. Mikhailova (2002) the local Strigunovsky variety is a variety population consisting of five biotypes: flat shape 2.7-3.7%; round-flat shape – 38.2-42.7%; round shape – 27.6-24.5%; long round shape – 29.0-25.3%, oval shape – 2.4-3.8%, which does not correspond to the variety description [2]. This local bulb onion variety of the Belgorod region has high economically useful qualities, such as storability [4, 5]. At the beginning of the 20th century at the World Exhibition in Paris the Strigunovsky variety of bulb onion was awarded the Gold Medal. Since 1943 this variety has been included in the State Register of Breeding Achievements. In 1961 the collective farm named after Lenin in Borisovskiy district of Belgorod region was awarded the "Big Silver Medal" for the special qualities of Strigunovsky onions at the international agricultural exhibition of the socialist countries in Erfurt [6]; the bulb onion was awarded a gold medal at the Leipzig Spring Fair in 1974. The Strigunovsky variety of local bulb

onion became the hallmark of not only the village, but the whole district [7]. The onion yield was over 6 000 tons per year at the household. Today in the village Strigun very few farmers cultivate it on backyards and primary onion seed breeding is not carried out at all [8].

At the end of the 90s in the last century the laboratory of primary seed breeding of vegetable crops at the Belgorod State Agricultural Academy has maintained varietal reproductive qualities of bulb onion [9-12], but in the following years this process stopped due to the expansion of foreign varieties and hybrids. In 2014 by the Government decision in the Belgorod region one has decided to restore the varietal qualities of local onions with the purpose of import substitution.

II. EXPERIMENTAL

The effectiveness of conservation methods for varietal parameters depends primarily on the conditions of the region of its origin, on abiotic and biotic factors affecting the variability of the qualitative and quantitative bulb onion characteristics. The cultivation of bulb onion was carried out on a stabilizing background with agricultural technology adopted in the Belgorod region.

Nursery-garden of the origin lines of bulb onion Strigunovsky was built at the collection area of the Department of Plant Growing, Selection and Horticulture in 2014; seed onion farming is carried out in the laboratory of selection of vegetable growing, horticulture and cloning at the Belgorod State Agricultural University. The researches were done according to existing methods and the developed program [13-15].

An analysis of variety structure and their reaction indicators were carried out on the basis of phenotypic observations for plants individually.

III. RESULTS AND DISCUSSION

7 best lines were selected in 2014-2018 during research of the local samples collection of the Strigunovsky varieties of bulb onion, selecting onion seedling and ovary according to morphological features and identifying typical samples for further selection and studying economically valuable indicators.

The differences between individuals in a number of plant characters (sizes, shape, color and others) and their functions without supportive selection have led to the phenotypic variability manifestation in the individuals' features within the same onion varietal under the influence of a certain complex of external factors on the plants. Insignificant differences were found in the onions lines in phenological phases. Green onion lodging occurred in 90-92 days in average; the difference in harvesting terms was 3 days.

Special place in the development of seed production belongs to the plant genotypes usage with high varietal purity, which includes approbation traits and fractional composition determining the least variability of features (bulb shape and color). Bulb shape index and color of cover scale are the main varietal indicators and therefore one has researched these traits variability. In the collection collected in the Belgorod region in 2014 the amount of mother onions with a typical color (light yellow with a pink) was 48.4% of the total mass and bulbs typicality in shape was 20.5%. By 2018 the stable varietal features as onion typicality in color was brought up to 100% and in shape - up to 99% (Fig. 1).

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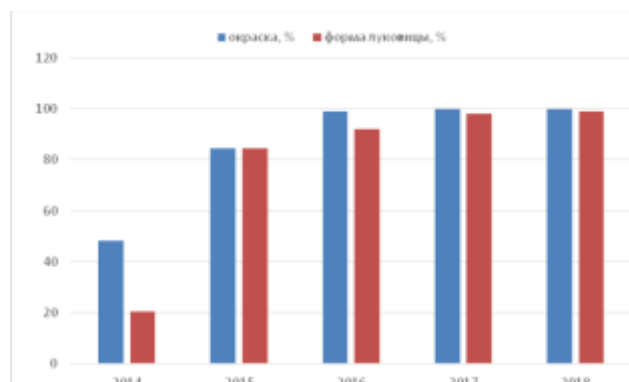


Fig. 1. Variability of economically valuable traits of the Strigunovsky local varieties of mother onion.

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On promising lines (families) of onions shape index was determined (Table I). In average the height of the bulb was from 5.1 cm to 5.5 cm, the width was from 4.9 cm to 5.5 cm and the shape index was 0.9-1.1.

All promising lines (families) were fixed in shape and size; the variation coefficient did not exceed 8.6%.

The most stable in these indicators were the lines (families) of S-1 and S-4.

The yield of mother plants of promising lines (families) were 300 thousand units per hectare from 29.8 t / ha to 42.7 t / ha according plant densities (Table II).

Bulb weight in promising lines (families) over the years varied depending on the climatic conditions from 124.7 ± 6.3 g to 142.4 ± 4.4 g (Table 3).

The bulb onion resistance to downy mildew contributes to a stable yield of bulb onion and its seeds.

TABLE I. BULB SHAPE INDEX OF PROMISING ONION LINES

Line	Bulb height, Xcp ±Sxcp, sm	Variation coefficient, %	Bulb diameter, Xcp ±Sxcp, sm	Variation coefficient, %	Shape index
C-1	5,3±0,2	5,4	4,9±0,2	5,6	1,1
C-2	5,2±0,3	6,2	4,9±0,3	6,9	1,1
C-3	5,1±0,2	5,6	4,9±0,3	6,2	1,1
C-4	5,4±0,2	5,1	5,3±0,2	5,4	1,1
C-5	5,5±0,4	8,6	5,3±0,3	7,3	1,1
C-6	5,4±0,2	6,2	5,5±0,4	8,1	0,9
C-7	5,1±0,3	7,4	5,0±0,2	6,6	1,0

TABLE II. YIELD OF MOTHER PLANTS OF BULB ONIONS ON YEARS

Line	Yield, ton/ha				Vendibility, %		
	2016	2017	2018	Xcp±Sxcp	2016	2017	2018
C-1	37,4	42,7	42,1	40,7±5,6	90,8	91,0	89,6
C-2	36,6	39,9	41,0	39,2±4,9	82,0	76,1	82,0
C-3	29,9	40,1	38,0	36,0±6,1	82,8	83,8	80,6
C-4	37,2	41,1	39,5	39,3±7,1	89,0	89,6	91,4
C-5	32,1	37,4	34,4	34,6±4,9	72,8	73,8	80,0
C-6	35,5	38,2	40,1	37,9±5,7	83,8	81,5	88,6
C-7	29,8	32,8	39,8	34,1±7,9	86,8	81,0	88,6
HCP05	7,32	6,80	6,60	-	1,60	2,77	2,20

TABLE III. INDICATORS VARIABILITY OF ONION MASS AND SEED PRODUCTIVITY

Years	Bulb mass, $X_{cp} \pm Sx_{cp}$, g	Seed productivity, $X_{cp} \pm Sx_{cp}$, g /plant
2016	124,7±6,3	3,9±0,1
2017	142,4±4,4	4,2±0,2
2018	140,2±4,2	4,2±0,2

Seed productivity of onion from one plant has varied from 3.9 ± 0.1 g to 4.2 ± 0.2 g.

During disease research of Strigunovsky local varieties of bulb onion it was noticed that disease was found at the level of 10-15% in 2018 with heavy rainfall in July. In the other seasons of the years the cases of disease were not noted.

IV. CONCLUSION

Thus, as a result of breeding work to restore the varietal qualities of Strigunovsky local variety of bulb onion the promising breeding lines were obtained, which have stable varietal characteristics such as the shape and color of the bulbs, the bulbs yield and seed productivity.

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