Breeding of Promising New Short- Climbing Forms of Squash

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Abstract: For the selection work in 2012 the samples of squash 0044SQ (Holland) and BT+KB-001 (Turkey) were selected from the gene pool of the Research Institute of Plant Industry of Uzbekistan. In 2013, the above squash specimens were studied in a nursery of source material, in which they were evaluated on biological and economically valuable features. As a result, they were identified as short-climbing, transportable, high-yielding squash lines LZ-2513 and LH-1916. The promising squash line LZ-2513 or the new variety Orbit was selected by selection from squash sample 0044SQ (Holland), and the line LH-1916 or the new variety Viridi by selection from sample BT+KB-001 (Turkey).

Breeding work was carried out in 2014-2018. In 2019-2020 competitive varietal trials were conducted in comparison with the variety standard Unumdor, included in the State Register of the Republic of Uzbekistan.

In the process of breeding there were selected zucchini lines LH-1916, or new variety Viridi with elongated fruits of dark green color from sample BT+KB-001 (Turkey) and LZ-2513, or new variety Orbit with rounded fruits of light green color from sample 0044SQ (Holland).

Keywords: squash, breeding, selection, line, variety, fruit shape, fruit color, early maturity, patent.

INTRODUCTION. Variety is a man-made group of economically valuable plants grown under certain conditions. Depending on the biological characteristics of plants of a given species and the degree of breeding, variety can occupy a different position in relation to intraspecific units. Thus, the variety is a systematic unit, it is a purely economic concept [1]. Protected objects, along with the variety, include a clone, a line, a first generation hybrid [4; 6].

A properly selected assortment is not only the way to a high harvest, but also a powerful tool for the rational use of land, climate, material and technical and labor resources [12; 14].

Biological characteristics of a variety ensure the possibility of growing under certain conditions and obtaining the appropriate product. Variety determines the time of cultivation and receipt of products, the quantity of the obtained product from a unit area, and its quality. The share of variety in production is 20-60 %. The size, timing, and quality of the crop, shelf-life, transportability, and yield of the product during processing depend on the variety chosen correctly. Varieties and hybrids behave differently in different conditions, so they should be selected experimentally for each zone [3; 5; 7].

Squash varieties are an early maturing vegetable crop with an attractive appearance. Research results show that they can be successfully grown under local conditions and are ideal for integration into the vegetable production systems of local farmers. Because of the short growing
time, this crop can be grown on several different planting dates during the cool growing season [9; 11].

Green squash varieties are hard and cylindrical, and the color varies from solid dark green to light green. Some varieties have stripes or spots of different shades of green. The yellow squash is a slender, bright yellow attractive vegetable. It is a fast-growing bush-type crop that matures in about 40-50 days. Yields of yellow squash tend to be lower than green varieties. When harvested early, this crop usually has a better price and better-quality fruit. Late harvesting can contribute to poor fruit quality [15].

When cultivating vegetable crops, the size and quality of the harvest depend largely on the variety used. Properly selected, adapted to local conditions, resistant to diseases variety is the basis for obtaining high yields. Therefore, breeding for stable yield and ecological plasticity is particularly important [10].

The basis of modern rationalization and strategy of rational human nutrition is both increasing the volume and expanding the range of vegetable crops, which will not only enrich the diet, but also serve to extend the period of consumption of vegetables, and thereby avoid the seasonal nature of the receipt of vegetable products [8; 13].

Creation of breeding material, breeding of new high-yield varieties possessing a complex of high values of economically valuable features, as well as improvement of cultivation technology of squash fruits and seeds are actual tasks in research works in the world, aimed at increasing the yield and improving the quality of products. At the present time in the USA, Italy, France, China, India, Japan, and Russia researches on the breeding of short-fruited forms of squash with different color and shape of fruits are carried out.

Very few studies related to squash culture have been conducted in Uzbekistan. The assortment in production consists of 10 F₁ hybrids of foreign breeding and 3 varieties of domestic selection Grecheskie 110, Unumdor and Gayrat. Selection and breeding of high-yielding, short-flowered squash varieties and improvement of elements of seed fruit growing technology is the actual direction of research to enrich the assortment of culture and seed production organization in the republic.

MATERIALS AND METHODS. In 2012, squash lines 0044SQ (Holland) and BT+KB-001 (Turkey) were isolated from the gene pool of the Research Institute of Plant Industry of Uzbekistan.

In the spring sowing in 2013, the above specimens of squash were studied in the collection nursery, where they were evaluated by biological and economically valuable features in comparison with the variety-standard. Unumdor variety (UzNIIR selection, which was submitted to the State variety testing as promising, introduced in the State Register in 2015) was used as a standard variety [2].

Double-row sowing, without repeats, 40 plants per plot.

In the breeding nursery throughout the breeding work families and lines in comparison with the variety - standard Unumdor were studied in 2014-2018. The variety-standard was placed every 10 plots. The best breeding significant individually selected samples were studied in 20 - 30 plots. In 2019-2020 competitive variety trials were conducted in comparison with Unumdor standard variety included in the State Register of the Republic of Uzbekistan.

RESEARCH RESULTS AND DISCUSSION. Mass shoots in the variety - standard and samples appeared on 8 days, and the number of days from sprouts to mass flowering of male flowers in the variety Unumdor was 39 days, the studied samples 37 days, ahead in development was 2 days.

In the phase of mass flowering of female flowers plants entered the sample: 0044SQ and BT+KB-001 on the 39th-40th day after receiving seedlings, and in the variety - standard on the
41st day. The growing season for the sample 0044SQ was 46 days, for BT+KB-001 47 days, for the variety - standard Unumdor 48 days.

When evaluating the squash sample number 0044SQ, the shape of the fruit varies within the progeny: rounded (91.2%), elongated (5.3%), and elliptical (3.5%). Plants with an unusually rounded fruit shape with an average mass of 270-300 g were isolated from this fruit form. Also in the squash sample, BT+KB-001 plants had fruits with different coloration: green (97.2%) and light green (2.8%) with an average weight of 180-210 g.

Selection by progeny is one of the main methods of breeding, used at all stages of the breeding process. To continue the breeding work, the best plants were selected by individual selection of 15 to 20 pieces. The seed harvest was selected from these fruits. Particular attention is paid to samples number 0044SQ with rounded fruit, light green color and from the sample BT+KB-001 - with elongated fruit, dark green color.

**Breeding nursery.** Throughout the breeding work (2014-2018), families and lines were studied in comparison with the Unumdor variety-standard.

Assessment of the duration of interphase periods showed that mass sprouts in the variety-standard and samples involved in breeding, appeared on 7-8 days. Observations of plants in the phase of mass flowering of male and female flowers showed that the studied zucchini samples did not differ significantly in duration of the period from sowing seeds to flowering. At spring sowing of the studied specimens, male flowering occurred on 35-37 days and female flowering on 37-40 days, i.e. in the period of plant development "shoots-flowering" of male and female flowers the difference between them is from 2 to 5 days (Table 1).

Table 1. Duration of interphase periods in plants of zucchini samples involved in the breeding process (average for 2013-2018)

<table>
<thead>
<tr>
<th>Variety, sample</th>
<th>Unumdor (St)</th>
<th>0044SQ (LZ-2513)</th>
<th>BT+KB-001 (LH-1916)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sowing-sprouting, days.</td>
<td>7-8</td>
<td>7-8</td>
<td>7-8</td>
</tr>
<tr>
<td>Sprouts - flowering of male flowers, days.</td>
<td>37-39</td>
<td>35-37</td>
<td>36-37</td>
</tr>
<tr>
<td>Sprouts - flowering of female flowers, days.</td>
<td>40-42</td>
<td>37-39</td>
<td>38-40</td>
</tr>
<tr>
<td>Sprouts to ripening of 1st seedling, days.</td>
<td>47-49</td>
<td>44-46</td>
<td>45-47</td>
</tr>
<tr>
<td>Sprouts to maturity of 1st seeded fruit, days.</td>
<td>95-100</td>
<td>89-94</td>
<td>90-95</td>
</tr>
<tr>
<td>Shape of fruit</td>
<td>elongated cylindrical</td>
<td>rounded</td>
<td>elongated-cylindrical</td>
</tr>
<tr>
<td>Coloring in technical ripeness</td>
<td>light green</td>
<td>light green</td>
<td>dark green</td>
</tr>
<tr>
<td>Color at biological ripeness</td>
<td>yellow with green stripes</td>
<td>yellow with green spots</td>
<td>green with small yellow spots</td>
</tr>
<tr>
<td>Weight of sprouts, g</td>
<td>180,0-200,0</td>
<td>270,0-300,0</td>
<td>200,0-215,0</td>
</tr>
<tr>
<td>Weight of seed fruit, g</td>
<td>2500,0-2560,0</td>
<td>1350,0-1460,0</td>
<td>1300,0-1480,0</td>
</tr>
<tr>
<td>Seed length, cm</td>
<td>32,0-34,0</td>
<td>10,0-11,0</td>
<td>33,0-35,0</td>
</tr>
<tr>
<td>Seed width, cm</td>
<td>9,5-11,0</td>
<td>17,0-18,0</td>
<td>9,0-10,0</td>
</tr>
<tr>
<td>Seed yield per fruit, g</td>
<td>31,3-33,0</td>
<td>21,0-23,0</td>
<td>20,0-22,0</td>
</tr>
</tbody>
</table>

When evaluating squash sample 0044SQ (LZ-2513) in terms of fruit shape, rounded fruit with an average weight of 270-300 g was selected. And in squash BT+KB-001 (LH-1916) samples with elongated-cylindrical shape of the fruit, with green coloring, with an average weight of 200-215 g were selected.
Determination of average mass of seed fruit in the varieties involved in the experiment allowed to establish that more than 2000 g had a variety - standard Unumdor (2500.0-2560.0 g), with samples had a mass of the fruit from 1300.0 to 1480.0 g. In sample BT+KB-001 (LH-1916) and the variety - standard, the fruit length was between 32.0 and 35.0 cm and width was between 9.0 and 11.0 cm. Sample 0044SQ (LZ-2513) had a fruit length of 10.0-11.0 cm and a width of 17.0-18.0 cm. Among the studied specimens of squash variety - standard Unumdor had the highest yield of seeds from one fruit - 31.3-33.0 g, and the lowest - was established in the tested specimens - 20.0-23.0 g. The study of samples in terms of seed yield from one fruit showed that seed yield does not depend on the shape of the fruit, but is a varietal trait.

In 2014-2015 in the breeding nurseries of the first and second year, the lines of squash BT+KB-001 (LH-1916) with elongated fruits of dark green color and 0044SQ (LZ-2513) with fruits of rounded shape of light green color were aligned.

As a result of scientific research, short-flowered, transportable, highly productive lines of squash LZ-2513 and LH-1916 were selected.

The process of creation of new lines of squash LZ-2513 and LH-1916 took several years and was carried out in accordance with the scheme of gourds breeding.

Squash line LZ-2513, or the variety Orbit, bred by analytical selection from the sample 0044SQ (Holland) is high-yielding, with unconventional rounded fruits. The plant is early maturing, the period from sprouting to the first harvest of the fruit is 44 days and has a short plumage form of the bush. The main stem is 75.0-90 cm long, with 25-30 cm long petioles. The leaves are large, 20-22 cm long, have a heart-shaped pentagonal green plate, pubescent, with spike-like hairs. Flowers are large, monodomous, bell-shaped, bright yellow. Fruits in technical ripeness have a green color, weighing 275-296 g., at biological ripeness the fruits acquire yellow color with green spots, weighing 1300.0-1420.0 g. The yield of seeds is 1.7-1.9%. Yield of greens 20.2 - 21.4 t/ha. Transportable (Fig. 1).

Squash line LH-1916, or Viridi variety, bred by analytical selection from sample BT+KB-001 (Turkey), early maturing (45 days to first harvest of fruit). Shaped shrub 70-90 cm long, with 22-28 cm long petioles, the leaves are large, 20-24 cm and medium-serrated, dark and light shades of green, spotted, pubescent, with spike-like hairs. Flowers are large, monotonous, bell-shaped and bright orange. The fruit is dark green in color, weighing 203-213 g. greens and fruit 1200.0-1430.0 g. The flesh is tender and cream-colored. The yield of seeds 1.5-1.7%. Yields are 18.5-19.3 t/ha. Transportable (Fig. 2).

CONCLUSIONS. In 2020, promising squash lines LZ-2513 (called "Orbita", NAP 20200087) and LH-1916 (called "Viridi", NAP 20200088) were submitted to the Intellectual Property Agency under the Ministry of Justice of Uzbekistan to obtain a patent for new varieties.
References


