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Comprehensive Study of Chili Pepper in Uzbekistan

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Abstract: ***In many countries selection is carried out, and new varieties and hybrids are creating, which are differ in shape, color, nutrient content, flavor and other characteristics, and they replenish existing assortment of chili pepper. Many varieties spread to other countries and adapted to the local climatic conditions [1, 2, 3, 4, 6, 7, 9, 10]. As a result of chili pepper accessions study: in Armenia, which were received from the World Vegetable Center (WorldVeg) scientists created new varieties. There are early ripening variety varieties Punj and Zspanak and mid-ripening variety Kon. Their yields are, respectively, 12.7 – 14.7 t/ha; 25.0 - 28.0 t/ha and 43.3 t/ha [5]. Since 1950 "Margelan-330" was the only variety of chili pepper which was zoning in Uzbekistan, with yield of 13-15 t / ha [8]. Due to the absence of the necessary germplasm no study of the new accessions was carried out up to present time. Chili pepper World collection of World Vegetable Center (WorldVeg) has a rich diversity and its study and selection of promising accessions for selection is important for Uzbekistan.***

Keywords: chilli pepper, Margelanskiy-330, vegetation, morphological parameters

1. Introduction

In many countries selection is carried out, and new varieties and hybrids are creating, which are differ in shape, color, nutrient content, flavor and other characteristics, and they replenish existing assortment of chili pepper. Many varieties spread to other countries and adapted to the local climatic conditions [1, 2, 3, 4, 6, 7, 9, 10].

As a result of chili pepper accessions study: in Armenia, which were received from the World Vegetable Center (WorldVeg) scientists created new varieties. There are early ripening variety varieties Punj and Zspanak and mid-ripening variety Kon. Their yields are, respectively, 12.7 – 14.7 t/ha; 25.0 - 28.0 t/ha and 43.3 t/ha [5].

Since 1950 "Margelan-330" was the only variety of chili pepper which was zoning in Uzbekistan, with yield of 13-15 t / ha [8]. Due to the absence of the necessary germplasm no study of the new accessions was carried out up to present time. Chili pepper World collection of World Vegetable Center (WorldVeg) has a rich diversity and its study and selection of promising accessions for selection is important for Uzbekistan.

2. Research Methods

Research work was carried out in 2008-2016 years in the Scientific Research Institute of Plant Industry (Uzbekistan) with using of the following guidelines:"Methodology of the State strain testing of crops." Issue 4 M. "Kolos" (1975);"VIPI guidelines for the study of world collection of pepper"(1977), "Guidelines for the study of chili pepper, AVRDC, Taiwan" (2006). For the evaluation of chemical composition were implemented the methods which are using in the laboratory of the Institute of Biochemistry(A.I. Ermakov et al. 1972).Statistical analysis of experimental data was made by Cropstat. We have conducted a comprehensive study of 15 chili pepper lines, introduced from WorldVeg. "Margilanskiy-330" was used as a check. Experiments on the collection study were made in a fourfold repetition. Dates of sowing seeds in the greenhouse and planting seedlings in open ground were generally accepted for the Tashkent region. Planting seedlings in the field was a single-row under the scheme 70x30 cm. Double rowplots, 10 plants were placed on each row. Around the experimental plot shelterbelts of chili peppers were planted.

3. Results

Vegetation Period

The period from sowing to mass shoots of seedlings from of 11accessions, same as the check variety "Margelanskiy-330" took 18-19 days, and only for 3 accessions the period was longer for 1-2 days.

After planting seedlings in open ground the plants 50% flowering phase of the check "Margilan-330" was on the 73 day. Flowering of 9852-173 and PP9955-15accessions was observed for 6-10 days earlier, flowering of 0437-7506, 0437-7509 and ICPN-11#9 accessions for 3days earlier.

According to the maturation of fruit, most of them were mid-ripening (120-140 days). Samples of 0407-7538, 0437-7510, 0437-7506, 0438-8543-3, 0038-9155-5-1, PP 9852-173 and PBC-142 were late-maturing (over 140 days). Accessions0407-7538, 0437-7510, 0437-7506, 0438-8543-3, 0038-9155-5-1, PP 9852-173 and PBC-142 were late-ripening (over 140 days).

The most important morphological parameters

Among the studied accessions there were no samples with very high or low plant height. Check variety "Margilanskiy-330" and 10 accessions plants had the mid-high 35-55cm. Accessions 9955-15, 0407-7567, PBC-142 and 9950-5197 had the plant height from 59 to 66 cm and belonged to a group of high plants.

The diameter of the check bush "Margilanskiy-330" was 48 cm. Close rate had accessions 0407-7567, 0437-7506, 0437-7509, 0437-7510, 9950-5197, 0407-7538 and RR9852-173.The lowest rates (for 60-83% less than the check variety) had 9852-173, 0438-8543-3 ICPN-11# 9, and 0038-9155-5-1 RR9955-15. It should be noted that most plants had a compact bush. Direct type of stem had accessions 0407-7567, PBC-142; creeping stem type had ICPN-11#9 and 0038-9155-5-1. There were no very small fruits in the studied accessions collection (less than 4 cm). Only two accessions PBC-142 andPP 9852-173 had small length of

the fruits (6.8-8.0 cm). Ten accessions belonged to the middle group and had 10, 1-12, 9 cm fruits length.

Check variety "Margilan-330" had long fruit-19, 0 cm. Longer fruits (22, 8-25, 3 cm) had only 9955-15 and 0337-7069 accessions.

Fruits of check variety "Margilanskiy-330" had a wedge-elongated shape. The rest of the accessions had elongated fingerlike shape (9955-15, 0038-9155-5-1); horn-shaped (0407-7538, 9950-5197, 0337-7069, 0407-7567), finger-shaped (9852-173, 0438-8543-3); small finger-shaped (0437-7509, PBC-142); blunt-pointed (0437-7510); short finger-shaped (ICPN11 # 9); trunk like small-fruited (PP 9955-15, PP 9852-173).

There were no fruits in collections with 4 cm in diameter. Most of them according to this indication belonged to the small-fruited (1, 1-2, 1sm). Eight accessions had a width of fruit 0.4-0.9 cm and they were attributed to very small-fruited group. According to the width of the fruit (2.7-2.8 cm) referred to a middle group check variety "Margilanskiy-330" and accession 0438-8543-3; to a small group (1-2.5 cm) 6 accession.

Check variety "Margilanskiy-330" had 1 mm wall thickness of the fruit. Similar measure had 12 more accessions. Twice thicker the wall thickness of the fruit had PBC-142, three times thicker the wall thickness of the fruit had 9852-173 and 0437-7510.

The bitterness of chili pepper fruits of the accessions was different. Thus, the bitterness of check variety and accession PP 9852-173 was poor. The taste of the fruit was not bitter of the accessions 0407-7538 and 0437-7506. The middle level of bitterness had 5 accessions and high level 7 accessions.

Disease resistance

During the vegetative period of the plant chili pepper accessions 0437-7506; ICPN-11 # 9; 0438-8543-3 and 0038-9155-5-1. It affects in a very low extent macrosporios is (Macrosporium) (less than 1 point), it had no significant effect on yield.

Yield

The yield depends on the variety and the constituent elements - the quantity and weight of the fruit.The average weight of marketable fruit from check variety "Margilanskiy-330" was 34.2 g, close to that weigh accessions 8855-15 (32, 4 g), 0337-7069 (29, 0 g), and accessions 0038-9155-5-1 (26, 9 g), 0437-7506, 0407-7538 (23, 7 g). The rest accessions had weight from 7.2 to 22.8 g.

Number of marketable fruits per plant (34 pcs.) had the check variety "Margilanskiy-330"and accessions 0038-9155-5-1, 0407-7538 and 0438-8543-3. A large number of fruits per plant had accessions 8855-15 (on 50, 0% large than check variety), 0337-7069 (on 41, 2%), 0437-7506 (on 20, 6%) and ICPN-11 #9 (on 35, 3%). Mark accessions with a large number of fruits, which were larger in comparison with the check variety. That are accessions 9950-5197 (on 138, 2%), 0437-7509 (on 208, 8%), 0437-7510 (on 205, 9%).

Table 1: The number of fruit weight and yield per bush of chili pepper

Accession	The average fruit weight		The number of fruit per plant		The yield per plant	
	g	at% to the check	pc.	at % to the check	g	at % to the check
Margilanskiy-330, st.	34.2	100.0	34	100.0	731	100.0
9955-15	32.4	94.7	51	150.0	1780	243.5
0337-7069	29.0	84.8	48	141.2	1762	241.0
0407-7567	10.3	30.1	43	126.5	493	67.4
9852-173	19.1	55.8	38	111.8	106	14.5
0437-7506	26.9	78.7	41	120.6	729	99.7
0437-7509	22.8	66.7	71	208.8	588	80.4
PBC-142	26.4	77.2	20	58.8	473	64.7
0437-7510	16.1	47.1	70	205.9	614	84.0
9950-5197	10.3	30.1	47	138.2	549	75.1
0438-8543-3	7.2	21.1	33	97.1	392	53.6
ICPN-11 #9	16.3	47.7	46	135.3	745	101.9
0038-9155-5-1	26.9	78.7	34	100.0	566	77.4
PP 9955-15	14.1	41.2	30	88.2	124	17.0
PP 0337-7069	23.7	69.3	34	100.0	777	106.3
PP 9852-173	10.7	31.3	28	82.4	184	25.2
x	*20.4*	-	*41.8*	-	*663*	-
LCD$_{05}$	*1.12*		*1.90*		*2.3*	

Yields of plants depended not only on the number of fruits per plant, but also on the mass of marketable fruit. The yield of check variety "Margilanskiy-330" was 731 g per plant, and relatively close to the check rate on 99, 7-106, 3% had accessions 0437-7506, ICPN-11#9 and 0407-7538.The lower figures (64, 7-77, 4% to check) had accessions 0407-7567, PBC-142, 9950-5197, 0038-9155-5-1 and very low productivity (14, 5-53, 6% to the check) had accessions 9852-173, 0438-8543-3, PP 9955-15 and PP 9852-173. Significantly higher (241, 0-243, 5% to the check) productivity had only accessions 0337-7069 and 9955-15.

Chemical composition

Technical maturity of fruits

Chemical analysis of the various accessions showed in technical maturity of fruit, that st. "Margelanskiy-330" ascorbic acid content was 61.3 mg /%.The average content of all accessions was 61.4 mg /%. Very low rate had

accessions 0437-7509, 9950-5197, ICPN-11 #9, PP 9852-173 (61, 0-67, 9%) and low - 9955-15 and 0337-7069 (70, 1-75, 9% to check).

On the content of ascorbic acid in the fruit close check (104.6-107, 5%) to check had accessions 0437-7510; 0438-8543-3; 0038-9155-5-1. On 114.4% highest ascorbic acid had accession 0437-7506; accessions 0407-7567 and 9852-173 - on 124, 3-129, 9%; respectively. Very high rate in had accessions PP 9955-15 (142, 1%) and 0407-7538 (148, 1% to check).

The solids content of accessions were different in the technical maturity. Accessions 0337-7069 and PP 9852-173 had 3, 71-3, 82%; 9955-15, 0437-7509, 9950-5197 and ICPN-11#9 - 4, 16-4, 65%; Seven accessions including check "Margilan-330" had 5, 14-5, 77% of solids. The highest content of solids (6, 01-6, 52%) had accessions of 0437-7510, 0438-8543-3 and 0038-9155-5-1.

Analysis of green fruits in technical maturity showed that predominant sugar is monosaccharides and sucrose was found in 4 accessions only. The check «Margilanskiy-330" fruits had 1.70%sugar content. A similar figure to it, was in accessions 0407-7567, 0437-7510, 9950-5197, PP 9955-15 and PP 9852-173. Accessions 9955-15, 0337-7069, 0437-7509 and ICPN-11 #9 had sugar content 81, 2-89, 4% to check.

High sugar content distinguished accessions 9852-173 (at 124.1% to the check), 0437-7506 and PBC-142 (122, 4%), 0038-9155-5-1 (115, 3%) and 0407-7538 (120% to the check) (table. 2).

Table 2: The chemical composition of chili pepper accessions in technical maturity of fruits

Accession	Ascorbic acid, mg/%	Solids, %.	Sugar, %			N-NO3, mg/kg
			monosaccharides	sucrose	total	
Margilanskiy -330, the check.	61.3	5.44	1.65	0.05	1.70	8.75
9955-15)	43.0	4.38	1.38	-	1.38	6.64
0337-7069	46.5	3.71	1.38	-	1.37	5.32
0407-7567	76.2	5.27	1.79	-	1.79	7.96
9852-173	79.6	5.49	2.11	-	2.11	9.96
0437-7506	70.1	5.94	1.89	-	1.89	7.96
0437-7509	37.4	4.48	1.52	-	1.52	7.30
PBC-142	75.4	5.77	2.05	0.03	2.08	9.28
0437-7510	65.9	6.52	1.66	-	1.66	8.62
9950-5197	39.0	4.65	1.58	-	1.58	10.6
0438-8543-3	63.8	6.01	1.88	-	1.88	9.17
ICPN-11 #9	41.6	4.16	1.46	-	1.46	12.4
0038-9155-5-1	64.1	6.15	1.96	-	1.96	9.28
PP 9955-15	87.1	5.14	1.83	0.01	1.84	8.62
0407-7538	90.8	5.28	2.0	0.04	2.04	7.96
PP 9852-173	40.6	3.82	1.71		1.71	6.64
x	61.4	5.138	1.7406	0.03	1.75	8.52
LCD05	2.5	1.8	1.5	1.1	1.5	2.1

In the phase of technical maturity of fruits nitrate content of the check "Margilanskiy-330" was 8.75 mg / kg. Close to the average rate were accessions 0407-7567; 0437-7506; PBC-142; 0437-7510; 0438-8543-3; 0038-9155-5-1; PP 9955-15 and 0407-7538.

Significantly more nitrates were in the fruit accessions 9852-173 (113, 8% to the check), 9950-5197 (121, 1%), ICPN-11#9 and significantly less - 0437-7506 (91%), 0407-7538 (91%), 0337-7069(60, 8%), 9955-15 (75, 9%), 0437-7509 (83, 4%) and PP 9852-173 (75, 9% to the check).

The most significant was the correlation of ascorbic acid content with the content of sugars (r=0, 80±0, 14). Between the level of ascorbic acid and the weight of dried fruit correlation was average (r=0, 35±0, 25). Between the content of ascorbic acid and nitrate content in the fruits was positive correlation (r=0, 09±0, 27).

In technical maturity of the fruit correlation is very strong between the content of ascorbic acid and the weight of fresh fruit (r=1, 05±0, 08). Between the content of ascorbic acid with the technical and biological maturity of fruits correlation is strong (r=0, 89±0, 12).

The biological maturity of the fruit

In phase of biological maturity ascorbic acid content of fruits st. "Margilan-330" was 84.1 mg /%, and the average rate of all accessions - 93.9 mg /% (111.75 to the check). According to this indication low rates had accessions 9955-15, 0337-7069, 0437-7509, 9950-5197, ICPN-11#9 and PP 9852-173 (58, 9-68, 1 mg/% or 70, 0-81, 0% to the check). High content of ascorbic acid in fruit 95, 9-105, 9 mg /% stood out accessions PP 9955-15, 0437-7510 (114, 0-125, 9% to the check); very high content of the accessions had 9852-173 (159, 3% to the check), 0437-7506 (125, 9%), PBC-142 (145, 2%), 0438-8543-3, 0038-9155-5-1, 0407-7538 (167, 1% to the check).

The solids content of the check variety was 7.24%. The average rate of all accessions was 6.22% (85.9% to the check). Very low rate of 4, 35-4, 91% trait characterized accessions 0337-7060 and ICPN-11#9 (60, 1-60, 9% to the check). Low solids content 5, 15-5, 90% (71, 1-81, 5% to the check) had accessions 9955-15, 0437-7509, 9950-5197, PP 9852-173. Averages rates 6, 20-6, 95% (85, 6-96, 0% to the check) had accessions 0407-7567, 9852-173, 0437-7506, PBC-142, 0437-7510, 0438-8543-3 and 0407-7538. Most

solids had accessions 0038-9155-5-1 и PP 9955-15 (1, 8-3, 3% to the check) (table. 3).

Table 3: The chemical composition of chili pepper accessions at biological maturity of fruits

Accession	Ascorbic acid, mg/%. мг/%	Solids, %.	Sugar, %			N-NO3, mg/kg
			monosaccharides	sucrose	total	
Margilanskiy-330, the check	84.1	7.24	2.45	0.25	2.70	14.7
9955-15	60.7	5.90	1.83	-	1.83	12.4
0337-7069	68.1	4.35	1.69	-	1.69	12.4
0407-7567	110.2	6.30	2.43	0.09	2.52	14.1
9852-173	134.0	6.20	2.52	0.16	2.68	16.9
0437-7506	105.9	6.67	2.13	0.11	2.24	13.2
0437-7509	64.4	5.57	1.89	0.03	1.92	11.5
PBC-142	122.1	6.35	2.83	0.22	3.05	18.5
0437-7510	98.1	6.87	2.67	0.10	2.77	10.6
9950-5197	62.7	5.15	2.0	-	2.0	15.9
0438-8543-3	115.5	6.95	2.96	0.16	3.12	14.7
ICPN-11 #9	62.0	4.41	1.75	0.05	1.80	17.2
0038-9155-5-1	119.9	7.37	2.98	0.16	3.14	16.6
PP 9955-15	95.9	7.48	2.87	0.10	2.97	15.9
0407-7538	140.5	6.93	3.11	0.11	3.22	15.0
PP 9852-173	58.9	5.73	1.96	0.08	2.04	14.1
x	93.9	6.22	2.38	0.12	2.41	14.6
LCD05	3.1	2.8	1.8	1.3	2.1	2.3

In biological maturity the fruit total sugar content of the check. "Margilanskiy-330" was 2.70%, and the average rate of all accessions was 2.41% (89.3% to the check). The collection had accessions with low content of 1, 69-1, 92% total sugar 9955-15, 0337-7069, 0437-7509, ICPN-11#9 (62, 6-71, 15 to the check). The average content of the sugar was in 8 accessions - 2, 0-2, 97%. Fruits have more sugar accessions PBC-142 - 3, 05% (113, 0% to the check), 0438-8543-3 (3, 12%), 0038-9155-5-1 (3, 14%) and 0407-7538 (3, 22% or 119, 3% to the check).

The check «Margilanskiy-330" fruits in biological maturity the nitrate content was 14.7 mg / kg. The average accumulation of nitrate in the production of all accessions was 14.6 mg / kg. This amount is 13.7 times less than the maximum permissible content (MPC).

Relatively low 11, 5-13, 2 mg / kg of nitrate content was in accessions 0437-7509, 0437-7506, 9955-15, 0337-7069 (78, 2-89, 8% to the check) and the lowest in 10, 6 mg/kg - 0437-7510 (72, 1% to the check). Close to the check rate had accessions 9950-5197, 0438-8543-3, PP 9955-15 and 0407-7538 (95, 9-108, 2% to the check). With the content from 18.5 to 16.6 mg / kg of nitrates in fruits high performance had accessions PBC-142 (125, 9% to the check), ICPN-11#9 (117, 0%) and 0038-9155-5-1 (112, 9%).

Thus, a comparative evaluation of the chemical composition of the fruit shown that the content of chemical substances accumulate more in biological maturity, than technical maturity. Average statistics for all accessions substances were: ascorbic acid 61.4 (in technical maturity) and 93.9 mg /% (in the biological maturity); solids 6.2 and 5, 1%; total sugar 1.75 and 2.41% and the nitrate content 8.5 and 14.6 mg / kg, respectively.

4. Conclusion

Study of collection chili peppers accessions showed differences between them on morphological characters, the duration of the vegetation period, plant productivity and the content of chemicals in chili pepper fruits.

Marked out on a range of economically valuable traits accessions have been involved in the selection process and three new varieties have been bred, well adapted to the soil and climatic conditions. In the State Register of the Republic of Uzbekistan were included new high-yielding varieties of chili pepper "Tillarang", (9955-15), "Uchkun" (0337-7069) and "Mumtoz" (0407-7567). New varieties have expanded the range of chili peppers and growing at farms of the Republic.

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