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WATER EXCHANGE PROPERTIES IN THE LEAVES OF FOREIGN COLLECTION SAMPLES BELONGING TO *VICIA FABA* L. SPECIES.

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Abstract. The article presents the study results on the total water content in the leaves of *Vicia faba* L. species of foreign collection samples, the indicator on this trait was 74.9-88.9%. A high value for total water content was found in the ENTRY-22 sample (88.9%) and a slightly lower index for this trait was found in the ENTRY-50 sample (74.9%). It has been shown that the total water content in the plant leaf also depends on the genotypic composition. According to the water retention property of the leaves, the highest parameters were recorded in the ENTRY-19 sample (34.7%), and the lowest result was recorded in the ENTRY-1 sample (12.3%). High parameters of transpiration rate was found in the Bakla UNV-851 sample (214.2 mg/g.h), a low rate was found in the ENTRY-26 sample (63.1 mg/g.h).

Key words: Variety, sample, stomata, total water content, water retention capacity, transpiration intention, variation coefficient.

ВОДООБМЕННЫЕ СВОЙСТВА ЛИСТЬЕВ ОБРАЗЦОВ ЗАРУБЕЖНОЙ КОЛЛЕКЦИИ, ПРИНАДЛЕЖАЩИХ *VICIA FABA* L. SPECIES.

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Аннотация. В статье приведены результаты исследования общего содержания воды в листьях вида *Vicia faba* L. зарубежных коллекционных образцов, показатель по этому признаку составил 74,9-88,9%. Высокое значение общего содержания воды обнаружено в образце ENTRY-22 (88,9%), а несколько меньший показатель по этому признаку обнаружен в образце ENTRY-50 (74,9%). Показано, что общее содержание воды в листе растения зависит также от генотипического состава. По водоудерживающей способности листьев наиболее высокие показатели зафиксированы у образца ЭНТРИ-19 (34,7%), а наименьший результат - у образца ENTRY-1 (12,3%). Высокие показатели скорости транспирации обнаружены в образце Bakla UNV-851 (214,2 мг/г.ч), низкие – в образце ENTRY-26 (63,1 мг/г.ч).

Ключевые слова: сорт, образец, устьица, общее содержание воды, водоудерживающая способность, транспирационная направленность, коэффициент вариации.

Introduction

Water deficiency has become one of the most urgent problems in the world. In the Central Asian regions, the melting of glaciers is accelerating, the mechanism of economical use of water in agriculture is not fully developed. New energy-saving technologies require significant investment and government attention.

Efficient and economical use of water is required today. Therefore, it is necessary to plant drought-resistant agricultural crops. Among these crops, species belonging to the leguminous family have been an integral part of the population's diet for many centuries, but the nutritional potential of these plants has not been sufficiently evaluated, and their consumption is at a low level. This requires the selection and breeding of samples resistant to stress factors and various diseases, as a result of planting and breeding samples of leguminous grain plants from the world collection (CYMMIT, ICARDA), also by studying their genetic, physiological and biochemical characteristics.

Among leguminous plants, *Vicia faba* plant is of special importance, which is rich in nutritious proteins and considered a quality fodder product. The homeland of this plant is the Mediterranean Sea. It has been cultivated in Palestine since a thousand years before Christ. In ancient Egypt, *Vicia faba* was considered a sacred plant, and in ancient Greece it was highly revered. *Vicia faba* is a widely cultivated legume among the other plants, the seeds of which contain 32-40% protein, 56-60% carbohydrate, 2.5% sugar, about 2% fat, ascorbic acid (vitamin C), carotene (provitamin A) and a large amount of mineral salts, mainly containing elements of potassium, calcium, phosphorus, magnesium, sulfur and iron. Roasted bean powder, together with mint and garlic, is used as a main product and an ancient spice for second dishes in the cuisines of Bulgaria, Macedonia, Ukraine, Romania, and Moldavia [6, 7].

Globally, the cultivated area of *Vicia faba* is 2,511,813 ha, with a yield of 4,923,154 tons/year and an average annual yield of 1,960 kg/ha (FAO, 2018). China is the leading producer of *Vicia faba* with 36.7% of global production, followed by Ethiopia (20.1%), United Kingdom (8.2%) and Australia (7.7%) [8].

In drought conditions, the reduction of water availability and the increase of ABA in plant cells regulate cell metabolism. In addition, the increase of drought resistant substances such as proline, glycine may be one of the main molecular effects on drought stress [12]. Accumulation of solutes to maintain cell volume during water loss is osmotic flexibility [9]. Free radicals

induced by drought stress cause lipid peroxidation and deterioration of membrane permeability in plants [14].

In the study of the water exchange of plants in nature and their sensitivity to water deficit in the soil, the characteristic of leaf water retention capacity (WRC) has been studied [2].

According to A. Kholliev, S. Boriev, U. Norboeva [5], if the plant is provided with enough water, the physiological and biochemical processes in its body are activated. If the amount of water in the soil is higher or lower than the optimal level for the plant, then there is a negative effect on the passage of the above processes. During water deficit, low total water content, especially low free water content in plants often results in premature opening of buds.

According to Kafi, M. Damghany Mahdavi [10], resistance to water shortage in plants depends on the efficiency of using the available water reserve. Plants with high water use efficiency are drought tolerant, the adaptation and metabolic pathway of some plants, such as CAM and C_4 plants, enable them to activate water stress response mechanisms in dry environments.

Plants begin to shed their old leaves in order to maintain a moderate amount of water in their leaves. This arrangement of leaves is carried out to improve adaptability to long-term environmental changes and water deficit [13]. Leaf shedding during water stress is mainly the result of increased sensitivity in plants [11].

The process of transpiration in a plant is the evaporation of water through a leaf, and it is a physical process in which water becomes intercellular vapor in the leaf, diffuses through the stomata and is released into the environment. The process of transpiration depends on the amount and size of water-conducting tubes (large and small), the number of leaf stomata, the thickness of the cuticle layer, the state of protoplasmic colloids, the concentration of cell sap, etc. Water moves up the plant stem, as a result of transpiration, a suction force appears in the leaf cell, which absorbs water from the root hairs and delivers it to the leaf [1]. In order to prevent water losses, it is necessary to reduce evaporation, that is, transpiration [15].

Another importance of the process of transpiration in plants is that along with water, mineral substances absorbed by root hairs are also transported. In addition, the process of transpiration reduces the temperature of the leaves and prevents them from overheating [4].

Research object and methods

The research was carried out in the experimental areas of the "Biology" and "Genetics and Evolutionary Biology" departments of the Faculty of Natural Sciences of the Chirchik state pedagogical university and in the

"Molecular Biology and Bioinformatics" scientific laboratory.

Research object was ENTRY-1 ENTRY-15, ENTRY-19, ENTRY-22, ENTRY-26, ENTRY-29, ENTRY-35, ENTRY-40, ENTRY-41, ENTRY-46, ENTRY-50, ENTRY-55, ENTRY-56, ENTRY-57, ENTRY-59, ENTRY-62, Bakla UNV-851 collection samples belonging to *Vicia faba* L. species.

In research, the important physiological parameters of water exchange in the foreign collection samples of *Vicia faba* L. species were determined by the following methods: Total water content in leaves [4]; water retention properties of leaves [3]; transpiration rate [1].

Results

When the total water content in the leaves of foreign collection samples of *Vicia faba* L. species was analyzed in 2023, it was not observed that some samples were significantly different from each other (Table 1). Total water content parameters in *Vicia* bean samples averaged 74.9-88.9%. In the samples of the foreign collection, the highest parameter of total water content was observed in the ENTRY-22 sample, 88.9%, and the coefficient of variation was 2.7%, while a slightly lower indicator of this trait was found in the ENTRY-50 sample (74.9%). No significant differences were observed among the remaining *Vicia* bean samples (Table 1).

Table-1

Total water content in the samples of *Vicia faba* L. plants

№	Samples	Total water content, % in 2023			
		$\bar{x} \pm S\bar{x}$	Limit	S	V %
1	ENTRY-1	86,2±2,4	81,3-89,4	4,2	4,9
2	ENTRY-15	85,7±2,6	80,5-88,5	4,5	5,2
3	ENTRY-19	87,9±0,7	86,4-88,8	1,3	1,4
4	ENTRY-22	88,9±0,7	87,5-89,7	2,4	2,7
5	ENTRY-26	85,6±0,8	84,0-86,8	1,4	1,6
6	ENTRY-29	85,7±0,7	84,8-87,1	1,2	1,4
7	ENTRY-35	86,6±1,3	84,6-89,1	2,2	2,6
8	ENTRY-40	85,4±0,6	84,3-86,6	1,1	1,3
9	ENTRY-41	86,9±0,8	85,7-88,	1,3	1,6
10	ENTRY-46	85,1±0,8	83,8-86,6	1,4	1,6
11	ENTRY-50	74,9±7,0	60,9-83,7	12,2	16,3
12	ENTRY-55	87,6±0,6	86,8-88,8	1,1	1,2
13	ENTRY-56	86,8±0,7	85,7-88,3	1,3	1,5
14	ENTRY-57	87,0±1,1	85,6-89,2	1,9	2,2
15	ENTRY-59	85,3±0,3	85,0-86,0	0,5	0,6

| 16 | ENTRY-62 | 82,7±0,5 | 81,9-83,7 | 0,9 | 1,1 |
| 17 | Bakla UNV-851 | 85,8±0,4 | 85,18-86,6 | 0,7 | 0,8 |
| 18 | Bakla UNV-852 | 87,9±1,4 | 85,1-89,7 | 2,4 | 2,7 |

It is known that the water retention capacity of leaves (WRC) in plants is one of the indicators that is very important for the study of physiological processes. In our research, we also studied the trait of water retention capacity in plant leaves. It should be noted that the higher the numerical value obtained, the lower the WRC, and the lower the value, the higher the WRC. Because this indicator shows how much water has been used for evaporation after 2 hours compared to the initial amount of water in the leaves.

In 2023, water retention capacity in the leaves of the foreign collection of *Vicia faba* L. species was analyzed. According to the results, the index of water retention of the leaves determined after 2 hours in *Vicia* bean plants, in terms of WRC, the higher value was found in ENTRY-19 sample 34.7%, correspondingly, the coefficient of variation was 16.6%, while the low parameter for WRC trait was observed in sample ENTRY-1, 12.3%, respectively, the coefficient of variation was recorded as 10.7% (Table 2).

Table-2

Water retention capacity of the leaves of *Vicia faba* L. species

№	Samples	Water retention capacity (%) in 2023			
		$\bar{x} \pm S\bar{x}$	Limit	S	V %
1	ENTRY-1	12,3±0,7	11,4-13,8	1,3	10,7
2	ENTRY-15	15,9±2,2	13,3-20,8	3,8	24,2
3	ENTRY-19	34,7±3,3	28,1-38,7	5,7	16,6
4	ENTRY-22	25,0±1,0	22,8-26,4	1,8	7,5
5	ENTRY-26	22,7±4,8	16,9-32,2	8,3	36,6
6	ENTRY-29	21,8±2,4	17,1-25,0	4,1	19,0
7	ENTRY-35	13,1±1,4	11,3-15,9	2,4	18,4
8	ENTRY-40	31,8±4,7	23,0-39,1	8,1	25,5
9	ENTRY-41	19,4±4,2	11,5-26,0	7,3	37,8
10	ENTRY-46	28,6±3,4	23,7-34,8	5,8	20,4
11	ENTRY-50	21,4±3,8	15,6-28,6	6,6	30,8
12	ENTRY-55	23,1±2,3	19,7-26,4	3,9	17,1
13	ENTRY-56	26,7±4,0	18,7-31,5	7,0	26,2
14	ENTRY-57	23,0±2,3	20,0-28,0	4,1	17,6
15	ENTRY-59	25,6±2,4	20,9-29,4	4,3	16,8
16	ENTRY-62	18,9±1,9	16,1-22,5	3,2	17,3
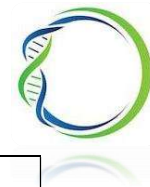
| 17 | Bakla UNV-851 | 33,1±3,4 | 26,9-38,2 | 5,9 | 19,0 |
| 18 | Bakla UNV-852 | 19,0±1,7 | 17,1-22,5 | 3,0 | 15,9 |

In our research, the parameters of the transpiration rate of *Vicia* bean samples during the flowering - yield forming period were studied.

The results of the study obtained in 2023 on transpiration rate index in the leaves of foreign collection samples belonging to the *Vicia faba* L. species were analyzed. The average transpiration rate index in the leaves of *Vicia* bean plants was 63.1-214.2mg/g .h (Table 3).

Table 3

Transpiration rate in the samples of *Vicia faba* L.species

№	Samples	Transpiration rate (mg/g.hour) in 2023			
		$\bar{x} \pm S\bar{x}$	Limit	S	V %
1	ENTRY-1	98,6 ± 3,5	93,0-105,0	6,1	6,2
2	ENTRY-15	114,3 ± 1,6	111,0-117,0	3,2	2,8
3	ENTRY-19	111,1 ± 1,7	108,0-114,0	3,0	2,7
4	ENTRY-22	153,9 ± 2,2	150,0-157,0	3,9	2,5
5	ENTRY-26	63,1 ± 3,8	55,0-65,0	6,6	10,5
6	ENTRY-29	88,4 ± 4,8	80,9-97,0	8,3	9,3
7	ENTRY-35	115,3 ± 1,3	113,0-117,0	2,3	1,9
8	ENTRY-40	136,0± 4,1	130,5-144,2	7,2	5,3
9	ENTRY-41	140,6± 3,7	133,0-145,8	6,5	4,6
10	ENTRY-46	96,7 ± 1,9	93,0-96,0	3,3	3,4
11	ENTRY-50	101,8 ± 3,1	97,0-108,0	5,2	5,4
12	ENTRY-55	126,5±3,4	119,8-131,5	6,0	4,7
13	ENTRY-56	116,5 ± 1,8	113,0-120,0	3,2	2,7
14	ENTRY-57	99,6 ± 3,7	95,0-107,0	6,5	6,6
15	ENTRY-59	102,6 ± 2,6	100,0-108,0	4,6	4,5
16	ENTRY-62	106,4 ± 3,2	100,0-108,1	5,7	9,1
17	Bakla UNV-851	214,2±4,6	206,1-222,2	8,0	3,7
18	Bakla UNV-851	79,9 ± 4,5	74,0-88,8	7,8	9,8

According to the analysis of the results obtained in 2023, the highest index of transpiration rate in the leaves of *Vicia* bean samples was 214.2 mg/g. h in the Bakla UNV-851 sample, and the coefficient of variation was 3.7%, and the lowest value for this trait was observed in the ENTRY- 26 sample (63.1 mg/g. h, correspondingly, the coefficient of variation was 10.5%). In the rest of the samples, it was observed that the rate of transpiration was significantly different from each other.

The obtained results of the research showed that the total water

content in the leaves of *Vicia faba* L. species of foreign collections was 74.9-88.9%. The highest parameters for total water content were found in the ENTRY-22 sample, 88.9%, and the slightly lower parameters for this trait were found in the ENTRY-50 sample (74.9%). This situation shows that the total water content in the leaves of plants also depends on the genotypic composition. Based on our results regarding the important physiological properties of water retention of leaves, we can conclude that the water deficit of plants in different phases (flowering – yield forming period) leads to disruption of their physiological processes, such as water exchange processes. According to the results of the analysis of leaf transpiration rate in *Vicia* bean samples in 2023, the highest value was noted in the Bakla UNV-851 sample (214.2 mg/g.h) and the lowest value in the ENTRY-26 sample (63.1 mg/g.h).

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СПЕКТРОФОТОМЕТРИЧЕСКИЙ АНАЛИЗ ФОТОСИНТЕТИЧЕСКИХ ПИГМЕНТОВ В МЕСТНЫХ И ЗАРУБЕЖНЫХ ОБРАЗЦАХ *SESAMUM INDICUM* L.

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Аннотация. В данной статье приведен спектрофотометрический анализ содержания хлорофилла «а», хлорофилла «b», общего хлорофилла,