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RESEARCH ARTICLE

Activity of Photosynthesis and Dynamics of Carbohydrates of Stachys l. Types in different Introduction Conditions

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ABSTRACT

In the article perennial ornamental, medicinal plants belonging to Stachys L. of the family Lamiaceae - Stachys byzantina C. Koch = S. lanata Jacq. and S. betonicaeflora Rupr. were the first described in detail the experimental data from the study of physiological processes in two unsalted (Tashkent) and saline (Mirzachul) soil-climatic conditions.

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Introduction

It is known that the process of photosynthesis in plants takes place in the leaves. Therefore, the structure of leaves and their condition depends on the genotype and growing conditions of plants, which determines the productivity of photosynthetic processes (Kuznetsov, Dmitrieva, 2011).

Photosynthesis is one of the main processes in the plant organism, and its dynamic state is determined by the organic influence of internal and external factors (Polevoy, 1989; Kuznetsov, Dmitrieva, 2011).

Any change in environmental conditions primarily affects the intensity and direction of photosynthesis processes. This in turn leads to certain changes in plant growth, development and productivity. The growth, development and productivity of plants in different climates and soil conditions are also directly related to the activity of various physiological processes, especially the process of photosynthesis.

Therefore, the main indicators of photosynthesis in the leaves of two species of Stachys (S.byzantina and S.betonicaeflora) in different soil and climatic conditions (unsalted and saline) were studied - the rate of photosynthesis, the ratio of photosynthesis and respiration.

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The experiments were conducted on the site of the Botanical Garden (Tashkent) and Boyovut district (Sirdarya region) on the territory of SFU "Navbahor".

The intensity of photosynthesis and respiration in the dark was detected in 3-4 leaves from top to bottom of the studied plants. The intensity of photosynthesis and respiration processes was carried out using Plant Vital 5030 (Germany) depending on the change in oxygen content. The amount of oxygen was determined with a Clark electrode (Tables 1 and 2).

In plants grown in Tashkent conditions, at the beginning of the growing season, ie in May, in S. byzantine respiration rate was 0.049 ± 0.004 mg O2 / l · sec., Photosynthesis rate was 0.083 ± 0.011 mg O2 / l · sec., Photosynthetic index was 1.69 ± 0.06. respiratory rate in S. betonicaeflora was 0.021 ± 0.002 mg O2 / l · sec., photosynthesis rate was 0.032 ± 0.004 mg O2 / l · sec., photosynthetic index was 1.53 ± 0.09. By mid (August), the respiratory rate in S. byzantine was 0.049 ± 0.003 mg O2 / l · sec, the rate of photosynthesis was 0.073 ± 0.006 mg O2 / l · sec, and the photosynthetic index was 1.49 ± 0.06. was During this period, the respiration rate in S. betonicaeflora was 0.034 ± 0.003 mg O2 / l · sec., The photosynthesis rate was 0.084 ± 0.009 mg O2 / l · sec., And the photosynthetic index was 1.79 ± 0.08. In plants studied at the end of growth and development (October), these values were as follows: respiration rate 0.038 ± 0.004 and 0.021 ± 0.002 mg O2 / l · sec., Photosynthesis rate 0.070 ± 0.008 and 0.027 ± 0.003 mg O2 / l · sec., the photosynthetic index was found to be 1.84 ± 0.09 and 1.28 ± 0.06 (Table 1).

Table 1. Intensity of photosynthesis and respiration in plants on the experimental plot in the Botanical Garden

Plant type	Date set	Respiratory rate, mg O2 / l · sec	Intensity of photosynthesis, mg O2 / l · sec	Photosynthetic index
S. byzantina	20 VI	0,049±0,004	0,083±0,011	1,69±0,06
S. betonicaeflora		0,021±0,002	0,032±0,004	1,53±0,09
S. byzantina	20 VII	0,036±0,003	0,052±0,006	1,44±0,06
S. betonicaeflora		0,023±0,002	0,029±0,003	1,27±0,08
S. byzantina	15 VIII	0,049±0,003	0,073±0,006	1,49±0,06
S. betonicaeflora		0,034±0,003	0,038±0,004	1,12±0,05
S. byzantina	15 IX	0,047±0,004	0,084±0,009	1,79±0,08
S. betonicaeflora		0,023±0,003	0,029±0,003	1,26±0,06
S. byzantina	15 X	0,038±0,004	0,070±0,008	1,84±0,09
S. betonicaeflora		0,021±0,002	0,027±0,003	1,28±0,06

In the plants studied in the experimental plot in Sirdarya at the beginning of the growing season in S. byzantina respiration rate was 0.038 ± 0.004 mg O2 / l k sec., Photosynthesis rate was 0.060 ± 0.005 mg O2 / l · sec., Photosynthetic index was 1.58 ± 0.05, S. in betonicaeflora, the respiration rate was 0.032 ± 0.003 mg O2 / l · sec., the photosynthesis rate was 0.047 ± 0.005 mg O2 / l · sec., and the photosynthetic index was 1.47 ± 0.10. By the middle of the growing season, the respiratory rate in S. byzantine was 0.057 ± 0.007 mg O2 / l · sec., The photosynthesis rate was 0.081 ± 0.009 mg O2 / l · sec., The photosynthetic index was 1.42 ± 0.08, and the respiration rate in S. betonicaeflora. the rate of extraction was found to be 0.043 ± 0.005 mg O2 / l. sec., the rate of photosynthesis 0.048 ± 0.006 mg O2 / l · sec., and the photosynthetic index 1.12 ± 0.05. At the end of the growing season, the respiratory rate in S. byzantine was 0.041 ± 0.004 mg O2 / l · sec., The rate of photosynthesis was 0.066 ± 0.008 mg O2 / l · sec., And the photosynthetic index was 1.60 ± 0.08. During this period, the respiration rate in S. betonicaeflora was 0.029 ± 0.003 mg O2 / l · sec., The rate of photosynthesis was 0.036 ± 0.004 mg O2 / l · sec., And the photosynthetic index was 1.24 ± 0.06 (2-. table).

Table 2. Intensity of photosynthesis and respiration processes in plants on the experimental plot in Sirdarya

Plant type	Date set	Respiratory rate, mg O2 / l · sec	Intensity of photosynthesis, mg O2 / l · sec	Photosynthetic index
S. byzantina	14 VI	0,038±0,004	0,060±0,005	1,58±0,05
S. betonicaeflora		0,032±0,003	0,047±0,005	1,47±0,10
S. byzantina	11 VII	0,046±0,005	0,061±0,005	1,33±0,07
S. betonicaeflora		0,039±0,005	0,049±0,005	1,25±0,06
S. byzantina	12 VIII	0,057±0,007	0,081±0,009	1,42±0,08
S. betonicaeflora		0,043±0,005	0,048±0,006	1,12±0,05
S. byzantina	11 IX	0,044±0,005	0,068±0,007	1,54±0,07
S. betonicaeflora		0,032±0,003	0,039±0,004	1,21±0,05
S. byzantina	12 X	0,041±0,004	0,066±0,008	1,60±0,08
S. betonicaeflora		0,029±0,003	0,036±0,004	1,24±0,06

According to the results of the research, the studied physiological processes - photosynthesis and respiration rate - were observed to change naturally depending on the type of plant, the growing season and growing conditions. In both studies, the intensity of photosynthesis was high in the afternoon (1300-1400), and in the following hours the rate of photosynthesis slowed down.

In the plants studied, the intensity of photosynthesis increases throughout the season, with the highest rates corresponding to periods of gross flowering and seed formation, which then decrease.

CO2 assimilated during photosynthesis is converted into carbohydrates, organic acids, proteins, fats and other substances in the cell. The amount of compounds formed during photosynthesis depends on the spectral composition of light and the type of plants and living conditions (soil moisture, mineral nutrients, temperature, etc.). By improving the living conditions of plants, it is possible to control the amount of product produced during photosynthesis. (Polevoy, 1989; Alexina et al., 2007; Kuznetsov, Dmitrieva, 2011).

It is known that carbohydrates are involved in many metabolic processes of plant cells. They are the primary products of photosynthetic activity of plants. Carbohydrates are widely used as an energy source in the living cell and as intermediate compounds in the synthesis of various compounds. It is important to study the effect of different environmental conditions on the amount of carbohydrates in plants and the role of carbohydrates in the processes of adaptation of the plant organism to soil salinity.

Therefore, the amount of carbohydrates in the different organs of stachis plants growing in two different environmental conditions was studied. According to the analysis of the obtained results, it was noted that the amount of carbohydrates in the various organs of the studied plants was directly related to their vegetation periods (Table 3).

Table 3. The amount of carbohydrates in stachys plants under different environmental conditions (% of absolute dry weight, 2010)

Plant type	Phases of development	Leaf	Root	Flower
In the conditions of Tashkent				
S. byzantina	growing	7,6±0,3	13,7±0,5	-
	flowering	7,8±0,3	14,2±0,6	6,3±0,3
S. betonicaeflora	growing	4,5±0,2	12,4±0,5	-
	flowering	6,1±0,3	16,1±0,7	7,9±0,4
In the conditions of Mirzachul				
S. byzantina	growing	7,8±0,3	14,8±0,6	
	flowering	7,9±0,3	15,1±0,5	6,4±0,3
S. betonicaeflora	growing	4,8±0,2	13,7±0,5	
	flowering	6,3±0,3	18,0±0,6	8,1±0,4

In the conditions of Tashkent, the total amount of carbohydrates in the S. byzantine plant during the growing season averaged 7.6 ± 0.3% in the leaves and 13.7 ± 0.5% in the roots. During the flowering period of the plant was 7.8 ± 0.3% in the leaves, 14.2 ± 0.6% in the roots, and 6.3 ± 0.3% in the flowers. In S. betonicaeflora, these values averaged 4.5 ± 0.2% in the leaves during growth, 12.4 ± 0.5% in the roots, and 6.1 ± 0.3% in the leaves during the flowering period, 16 in the roots. 1 ± 0.7%, 7.9 ± 0.4% in the flower (Fig. 1).

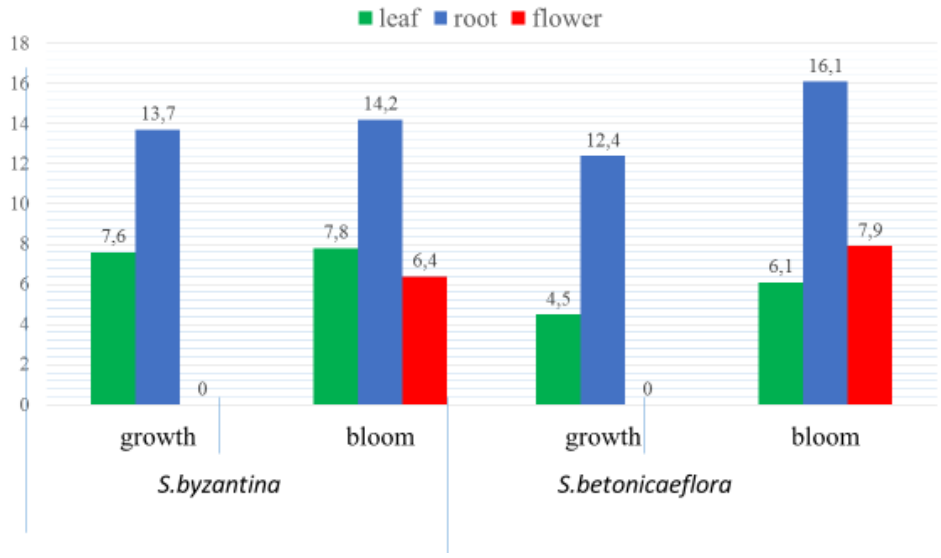

Figure 1. The amount of carbohydrates in S. byzantine and S. betonicaeflora in the conditions of Tashkent,%

The total amount of carbohydrates in plants introduced in Mirzachul conditions was 7.8 ± 0.3% in the leaves during the growth period in S. byzantina, 14.8 ± 0.6% in the root, and 4.8 ± 0.2% in the leaves in S. betonicaeflora., at the root is 13.7 ± 0.5%. During the flowering period, this amount is 7.9 ± 0.3% in S. byzantine leaves, 15.1 ± 0.5% in the root, 6.4 ± 0.3% in the flowers, 6.3 ± 0.3% in the leaves of S. betonicaeflora., 18.0 ± 0.6% in the root and 8.1 ± 0.4% in the flowers (Fig. 2).

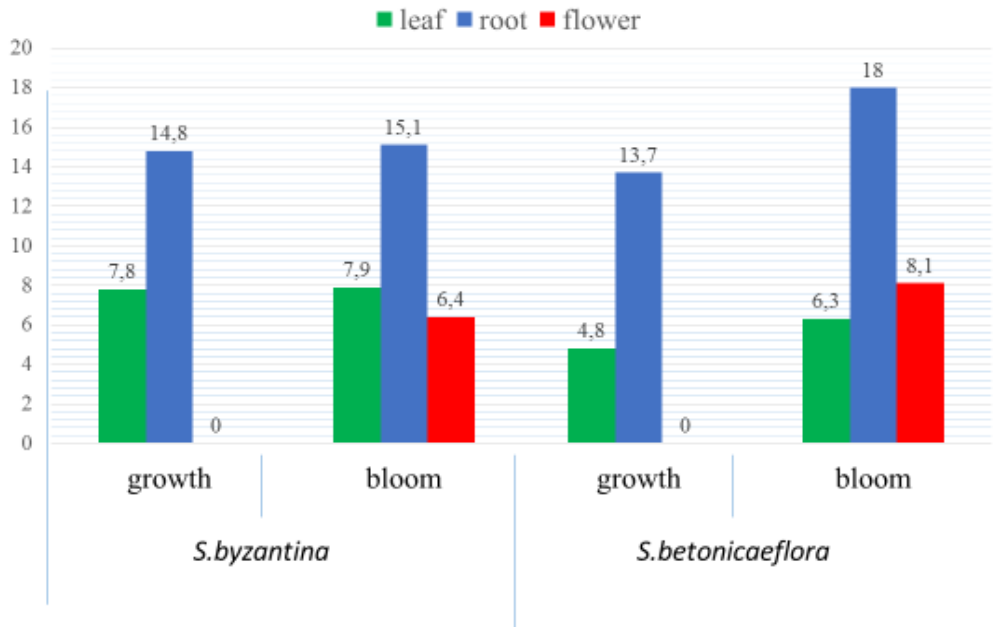

Figure 2. The amount of carbohydrates in S. byzantina and S. betonicaeflora in the condition of Mirzachul, %

The total amount of carbohydrates varies seasonally during the vegetation period of plants, and it has been observed that they are abundant in various organs, especially during the flowering period. According to the results of the experiments, chloride-sulfate salinization of soils in the Mirzachul region leads to a slight increase in the amount of carbohydrates in plants. An increase in the amount of carbohydrates in plants grown in saline soils is one of the most effective ways of their physiological adaptation to salinity - the accumulation of water-soluble carbohydrates in the cells. It is common to increase the amount of sugars due to the influence of adverse environmental factors (soil salinity, drought, etc.) on plants, which act as osmoprotectors, ie protect the protein-lipid components of the membrane from denaturation (Polevoy, 1989; Alexina et al., 2007).

The rapid accumulation of osmolytic substances such as amino acids, polyamines and carbohydrates in plant cells during soil salinization and drought is an effective mechanism of salt resistance.

According to B.P. Strogonov (1962), sugars also bind excess toxins in plants, regulating the balance of ions in plant cells.

Conclusion

In summary, the photosynthetic activity and respiration rate of the studied species of the Stachys L. family varied depending on the type of plant, the growing season, and growing conditions. In both species of stachys, the rate of photosynthesis increases during the season, with the highest rates observed during periods of gross flowering and seed formation, followed by a decrease.

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