METHODOLOGY FOR DETERMINING SOME MORPHOPHYSIOLOGICAL CHARACTERISTICS AND AMOUNT OF CAROTENOIDS IN STEMS OF HALOXYLON PERSICUM SPECIES

Tajibayev G'ulomjon Alisherovich

Abdikarimov Bobur Qurombayevich

Institute of Genetics and Plant Experimental Biology of the Academy of Sciences of the Republic of Uzbekistan

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Abstract. *In the study of some morphological and physiological characteristics of the Haloxylon species brought from the Aral Sea, we made scientific observations by comparing its species Haloxylon aphyllum and Haloxylon persicum under lysimeter and field conditions, and according to the experimental results, H. persicum is green It was observed that the branches developed better under lysimeter conditions compared to field conditions.*

Keywords: *H. aphyllum, H. persicum, lysimeter and field conditions, dominant species, green stem, chlorophyll, carotenoid, Arnon method.*

МЕТОДИКА ОПРЕДЕЛЕНИЯ НЕКОТОРЫХ МОРФОФИЗИОЛОГИЧЕСКИХ ХАРАКТЕРИСТИК И КОЛИЧЕСТВА КАРОТИНОИДОВ В СТЕБЛЯХ У ВИДОВ HALOXYLON PERSICUM

Аннотация. *При изучении некоторых морфологических и физиологических особенностей видов рода Haloxylon, завезенных из окрестностей Аральского моря, его Haloxylon aphyllum и Haloxylon persicum виды были подвергнуты научным наблюдениям путем сравнения их с помощью лизиметра и в полевых условиях, и, согласно результатам эксперимента, было замечено, что зеленые ветви H. persicum лучше развиваются в условиях лизиметра, чем в полевых условиях.*

Ключевые слова: *H. aphyllum, H. persicum, лизиметр и полевые условия, доминирующий вид, зеленый стебель, хлорофилл, каротиноид, метод Арнона.*

INTRODUCTION

The distribution of *Haloxylon* species in the dry part of the Aral Sea is being studied deeply, and there are three main reasons for this: 1). Drought resistance of *Haloxylon* species. 2). It is dominant over other species of plants growing around the Aral Sea and is spread over a wide area. 3). Physiological and biochemical properties of *H. aphyllum* and *H. persicum* plants of this category have not been thoroughly studied.

Since 1960, the water level of the Aral Sea has decreased and its dry level has increased. As a result of the retreat of the sea water, a typical desert composition was found in its place, consisting of a complex of huge sandy-sandy landscapes. This desert became known as "Orolqum", a natural region that appeared in the territory of Central Asia [1].

The species of *Haloxylon* family are very important desert plants, some of them have unique ecological, morphological, biochemical and physiological characteristics. *H. persicum* is a tree that can grow to a height of 5-7 m and can live up to 100 years

It often forms forest-type woodlands in some desert environments. *H. persicum* was described as a tree by Iljin 1936 [3], Butnik et al. 1991[4], or large bush Netchaeva et al. 1973 [2], or an intermediate form up to 5 m high. This plant is 25 to 30 years old Nikitin 1966 [5]. *H. aphyllum* is more cold and salt tolerant than *H. persicum* Netchaeva et al. 1973 [2].

Haloxylon species - their presence in areas with large diurnal growth and adaptation to annual temperature fluctuations have been observed.

RESEARCH METHODS

During our observations, while studying the physiology and morphology of Haloxylon species distributed along the island, we observed that the growth of *H. aphyllum* and *H. persicum* plants undergoes positive changes. We used different methods to determine the anatomical and morphological structure of individuals in the population, and the average height of *H. aphyllum* (black saxsaul) is 1.5-3 m, one plant is approximately 1-2 meters in diameter, bisexual, opposite, grain-shaped, in the axil of flowers. It is a single-rooted, leafless tree. Saxsaul's green branches serve to accumulate organic matter.

H. persicum (white saxsaul) is a large shrub with a height of 2.5-4 m, the root reaches a depth of 10-11 m, and it is of great importance in the national economy. It is mainly used as firewood (fuel), nutritious fodder for sheep and camels, sand stabilizer and wind breaker. Saksaul lives 50-60 years. Basically, it grows from seeds and begins to germinate normally in 5-7 years. Saksaul forests in Central Asia and Kazakhstan are 22 mln. around . Saksaul forests in Uzbekistan cover 1229 thousand ha, of which white saxsaul occupies 976 thousand ha and black saxsaul 253 thousand ha [6].

It is distributed all over the world mainly: It grows in the deserts and deserts of Kazakhstan, Central Asia, Iran, Afghanistan, Iraq, Saudi Arabia, Western China. It is widely distributed in Asian deserts and semi-deserts, saline lands, and saline sands [7].

Its distribution in Uzbekistan is mainly in: Karakum, Qizilkum and southern regions of the Aral Sea.*H. aphyllum* is one of the most famous desert plants living in the deserts of Uzbekistan, Kazakhstan and Turkmenistan [8].

H. persicum as a species is distinguished by its unique ecology, which is why it is a species of great scientific and practical importance even in the desert. These biologically stable and resistant tree species are used to trap and protect the volatile sands. Increasing fodder on pastures, protecting them from wind erosion, increases the productivity of pastures and protects animals from frequent winter storms.

Scientific research work was continued in the laboratory of the unique scientific object collection of phytopathogens and other microorganisms of the Institute of Genetics and Experimental Plant Biology of the Federal Republic of Uzbekistan. In this scientific research institute, work was carried out to determine some morphological and physiological characteristics of the *H. persicum* plant and primary scientific data were obtained. This information is currently being analyzed.

Research work 20 seedlings of *H. persicum* of the *Haloxylon* genus brought from the surrounding areas of the Aral Sea, experimental plots (8 per lysimeter) and 12 per field soil belonging to the Institute of Genetics and Experimental Plant Biology of the Academy of Sciences of the Republic of Uzbekistan was planted (Fig. 1).

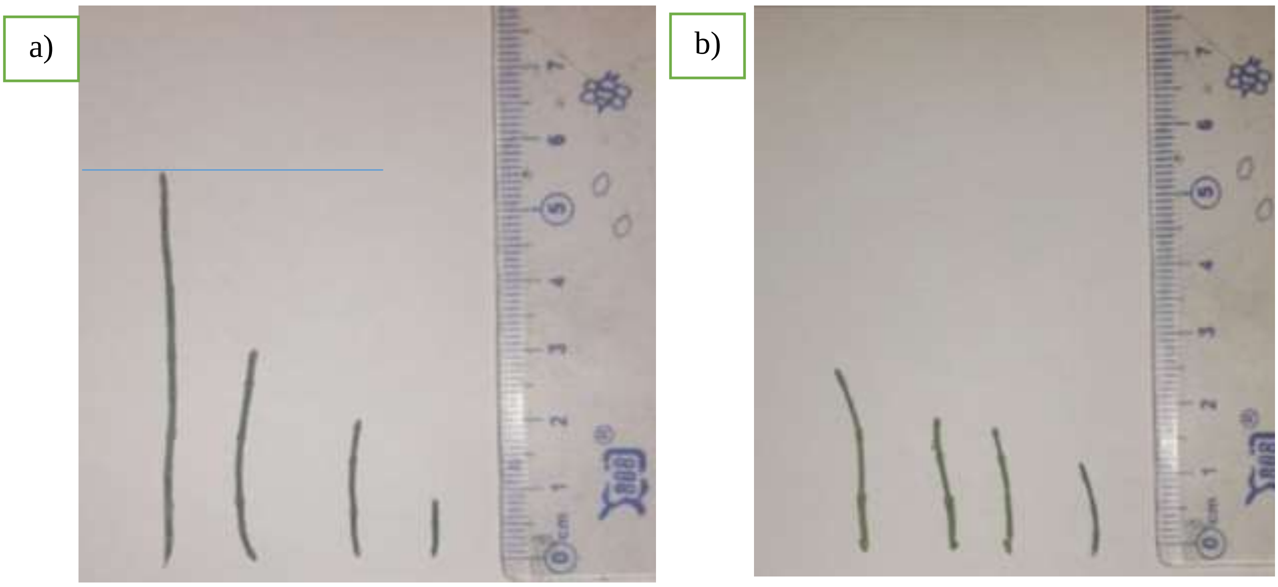
Figure 1.

***Haloxylon persicum* Institute of Genetics and Plant Experimental Biology relevant experimental field (April 2022).**

Scientific research works were followed the growth of H. persicum plant, the branching of the stem and the growth of green branches. The obtained results were analyzed in laboratory conditions (Fig. 2).

Figure 2.

Green shoots of *Haloxylon persicum* plant under lysimeter (a) and field (b) conditions



a) in the picture: The length of green branches of *H. persicum* - white saxsaul plant under lysimeter conditions increased by 5.6 cm in the high ratio, 2.5 cm in the middle ratio, and 1 cm in the low ratio.

b) in the picture: In field conditions, the length of green branches of *H.persicum*-white saxsaul plant increased by 3.7 cm in the high ratio, 2 cm in the middle ratio, and 1.4 cm in the low ratio.

The branching of the *H. persicum* plant that germinated in the experimental field of the Institute of Genetics and Experimental Plant Biology of our research work was determined and the number of green branches in each branch was determined (Fig. 3).

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Green branches of *H. persicum* plant

The results of the experimental field revealed that the number of branches of *H. persicum* plant is 7, the length of branches is 25 cm, the number of green branches is 11, and the length of green branches is 5.6 cm. This specimen is resistant to other species in the Aral Sea and flexibility has been proven.

This experiment was taken as a sample of 1-year-old green shoots of *H. persicum* plant, adapted to lysimeter and field conditions for 45 days. It consists in determining the amount of chlorophyll and coratinoids in the green branches of *H. Persicum* plant.

Russian scientist K. A. Timiryazev in 1875 [12] showed that light energy is involved in the process of photosynthetic changes through chlorophyll in plants. Starting from the middle of the 19th century, after new methods (gas analysis, isotope method, spectroscopy, electron microscopy methods, etc.) were used in the study of photosynthesis, the mechanisms of chlorophyll participation in photosynthesis were developed.

Chlorophyll belongs to the group of fat-soluble pigments, it is soluble in oils and organic solvents. Chlorophyll, as shown by K. A. Timiryazev and his followers, plays a very large role in the assimilation of carbon dioxide. The process of photosynthesis is the oxidation-reduction interaction of carbon dioxide and water, which occurs with the participation of chlorophyll, which absorbs the energy of sunlight. Photosynthesis is currently the main source of organic matter on Earth.

K. P. Petrov [9], in "Methods of biochemical analysis of raw materials", gives a method for determining chlorophyll according to T. N. Godnev. This method of analysis consists in extracting chlorophyll from the green part of the plant with a 96% ethanol solution and measuring the optical density of the extract.

Chlorophyll can also be quantified using chromatographic methods (according to Sapojnikov). Separation of the pigment mixture is based on selective absorption of filter paper. When the solution moves along the paper under the influence of capillary forces, its molecules are divided into two phases according to the separation coefficient (mobile and stationary phases).

Some sources describe in detail a spectrophotometric method for quantitative measurement of this chromoprotein. Spectrophotometric analysis is the most accurate quantitative method for determining the composition of leaf pigments. As in a photoelectric colorimeter, the concentration of pigments in a spectrophotometer is determined by optical density. However, unlike the first one, the spectrophotometer allows the analysis of mixtures of substances with a near absorption maximum, which is achieved using a monochromator, as a result of which it is possible to determine the content of chloroyl and carotenoids in the extract. without prior separation. In a spectrophotometer, the density of the extract is measured at the wavelengths corresponding to the absorption maxima of chlorophyll a and b in the red region of the spectrum and at the wavelength of the absorption maximum of carotenoids. In this case, the position of the absorption maximum is considered to vary slightly depending on the solvent used. The concentration of pigments is calculated according to equations [10, 11].

RESULTS OF THE RESEARCH

The amount of total chlorophyll a, b, and caratinoids was determined under the conditions of the *H. persicum* plant (lysimeter) of the *Haloxylon* species growing in the vegetation of the island. To determine the amount of chlorophyll *a*, *b* and *caratinoids* in the green shoots of *H. persicum* plant, using the Arnon method, green shoots of the plant were first brought to laboratory conditions at different hours of the day. 50 mg of the samples were weighed on an analytical balance in biological test tubes and the best solvent was chosen for extraction, and the most suitable solvent was 5 mg of 96% etonol alcohol. The glass was crushed using a stick and the finished extract was placed in the refrigerator at $+4^{\circ}C$ for 12 hours, and we can see the results of the spectrophotometer analysis in the tables below (Table 1).

Table 1.

The result of *Haloxylon persicum* plant in the experimental field for 45 days.

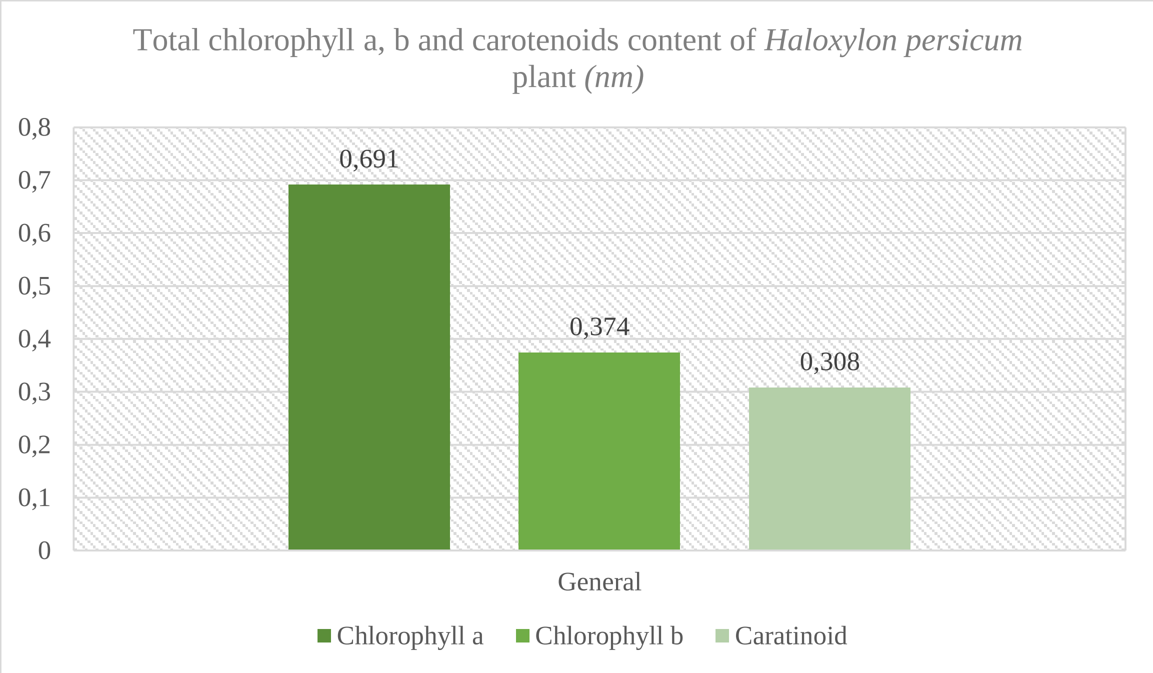
Green shoots of 1-15 days					
№	*Haloxylon persicum*	The time when the green shoots are taken (09:00 to 10:00)	The time when the green shoots are taken (13:00 to 14:00)	The time when the green shoots are taken (17:00 to 18:00)	General
1	Chlorophyll	0,675	0,631	0,835	0,714

	$(a)_{664}nm$				
2	Chlorophyll $(b)_{649}nm$	0,269	0,286	0,319	0,291
3	Caratinoid $(k)_{470}nm$	0,290	0,280	0,348	0,306
Green shoots of 2-15 days					
№	*Haloxylon persicum*	The time when the green shoots are taken (09:00 to 10:00)	The time when the green shoots are taken (13:00 to 14:00)	The time when the green shoots are taken (17:00 to 18:00)	General
1	Chlorophyll $(a)_{664}nm$	0,678	0,637	0,841	0,719
2	Chlorophyll $(b)_{649}nm$	0,263	0,281	0,314	0,286
3	Caratinoid $(k)_{470}nm$	0,293	0,278	0,339	0,303
Green shoots of 3-15 days					
№	*Haloxylon persicum*	The time when the green shoots are taken (09:00 to 10:00)	The time when the green shoots are taken (13:00 to 14:00)	The time when the green shoots are taken (17:00 to 18:00)	General
1	Chlorophyll $(a)_{664}nm$	0,646	0,672	0,603	0,640
2	Chlorophyll $(b)_{649}nm$	0,354	0,320	0,271	0,315
3	Caratinoid $(k)_{470}nm$	0,320	0,346	0,274	0,313

In the course of our research, we observed that *Haloxylon persicum* is a fast-adapting, resistant species compared to other species, and it is less demanding on heat and humidity. During the determination of plant chlorophyll, samples taken at different times of the day were used. The obtained results were summarized (diagram 1).

Diagram 1:

The total amount of chlorophyll (a), (b) and carotenoids in *Haloxylon persicum* plant.



CONCLUSION

Based on our research, the data obtained in the experimental fields of *Haloxylon persicum* - white saxsaul plant brought from the Aral Sea show that the green shoots of the white saxsaul plant are better developed in lysimeter conditions than in field conditions. This species, which is distributed in the Aral Sea, has proven its durability and flexibility compared to other species during our experiments. The plant *Haloxylon persicum*, distributed in the dry part of the Aral Sea, helps to trap volatile sands, develops well in salty sands, and improves the soil condition, and serves for the reproduction of other species.

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