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DETERMINATION OF THE CHLOROPHYLL LEVEL IN THE LEAVES OF THE PHASEOLUS VULGARIS L PLANT INFECTED WITH THE COMMON BEAN MOSAIC VIRUS

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ABSTRACT

In recent years, data have shown that only one bean plant can be infected with more than 10 viruses worldwide, each of which differs from each other in a number of characteristics, such as structure, morphology, and the symptoms it causes in the plant. One of these viruses is BCMV beans, which differs from each other in the pathogenicity of these viruses: a number of strains have been identified that are widespread around the world and cause significant damage to agriculture.

There is a sharp decrease in the amount of chlorophyll content in the leaves of legume plants infected with the bean mosaic virus. In this case, the virus is exposed to another foreign substance with the free radical chlorophyll.

Keywords: Bean simple mosaic virus, antioxidant, interferon, free radical, transpiration, photosynthesis, chlorophyll, potato mosmeaics, carotenoid, hyostiamine

INTRODUCTION

Chlorophylls are natural plant pigments that absorb sunlight due to their energy and their ability to produce carbohydrates from carbon dioxide and water in a process called photosynthesis[10,11,12]. Chlorophyll are plant organelles called chloroplasts, which green plants and some algae survive by producing energy from sunlight, water and carbon dioxide through photosynthesis. In the process, it is converted into light energy. Photosynthesis water and carbon dioxide are converted into glucose by sunlight, and oxygen is the basis of the environment. Photosynthesis plays an important role in maintaining the life of plants and other organisms, and oxygen regulates the amount of carbon dioxide. Returning to the process of photosynthesis, the main pigment facilitating the process is a green pigment called chlorophyll[2]. The three pigments absorb the red and blue wave rays of sunlight needed to start the photosynthesis process.

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Chloroplasts contain different chlorophylls, which make different contributions to the photosynthesis process. The following types of chlorophylls differ from each other.These are the following chlorophylls:

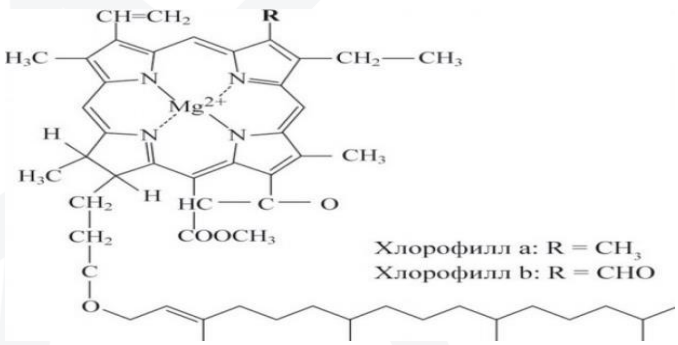
- **Chlorophyll A**: present in all higher plants, algae and cyanobacteria. In other words, it is present in all green plants except bacteria. This is the most common type of ray with effective absorption wavelengths of 429 Nm and 659 Nm.
- **Chlorophyll B:** This is a type of pigment that is responsible for transferring light energy to chlorophyll A (Picture). It is found in plants and green algae (mosses). It absorbs rays with wavelengths of 455 Nm and 642 Nm.
- **Chlorophyll C:** This chlorophyll pigment is mainly present in diatoms, dinoflagellates and service algae (seaweed) and includes wavelengths from 447 Nm to 452 Nm
- **Chlorophyll D:** This pigment is mainly found only in red algae, and they absorb light at wavelengths beyond the optical range, for example, 710 Nm[3,4].

Chlorophyll A and chlorophyll B play an effective role in plant photosynthesis. The main pigment responsible for photosynthesis is chlorophyll A. Chlorophyll B absorbs sunlight and transmits it to chlorophyll A. Chlorophyll A reflects blue-green light, and chlorophyll B reflects orange-red light. Chlorophyll a absorbs more of the red wave, and chlorophyll B absorbs violet-blue light[5,6].

Viruses are intracellular parasites that harm all living organisms to varying degrees, in most cases causing physiological processes occurring in them to help, as well as for productivity [1,2,3,4].

The study of the degree of influence of the virus on certain physiological processes in the tumor, the amount of chlorophyll that provides the process of individual photosynthesis, should be one of the important issues in the process of pathogenic induction of this [1,9].

Now four groups of this pigment have been discovered - A, B, C, D. In addition, only one group is involved in photosynthesis. Formulas of α-chlorophyll C_{55} h_{72} O_5 N_4 mg.



Picture. The acyclic formula of chlorophyll a and b

The base structure of chlorophylls of various groups is porphyrin, which is a compound with a magnesium atom, and a high-molecular hydrophobic alcohol attached to it, which promotes the incorporation of chlorophyll into the lipid product of photosynthetic membranes in plant chloroplasts. The absorption of sunlight transforms it into energy above the plant.

Did you know that? Chlorophyll was first described by the American chemist R. Fully synthesized, produced by Woodward.In 1960, a pigment that turns juveniles green was obtained by French chemists P. Peltier and J. Quantum called it "chlorophyll."[12,14](Picture)

RESEARCH MATERIALS AND METHODS

Therefore, the study of the bioecological characteristics of this virus, such as the degree of its spread in our country, reserve plants, distributors, is one of the important issues. BCMV is spread by mechanical, seed and aphids, a number of aphid plants, and also affects a number of wild and cultivated plants, in addition to beans[1].

A viral plant is a mixture of yellow and green mosaics on the leaves, in some cases dark green in color, a change in the shape of the leaves, usually accompanied by twisting, bubbles, distortion, twisting down [2,3]. This virus affects both wild and important cultivated agricultural plants, reducing yields and product quality, causing significant damage to the national economy.

University for this experiment on legumes grown in indoor conditions, phenological observations were carried out, and as a result of observation on plants, signs of the virus appear in the form of bright yellow mosaics on leaves, yellowing of veins, chlorotic spots on plant organs [5,6].

There are symptoms of such a disease from the “Black Eye” variety belonging to the genus Phaseolus vulgaris L, from plants infected with a virus of varying severity (strong, weak and medium), samples were collected and the levels of chlorophyll pigment (A and B) were studied, and the results are presented in the form of a graph (Picture.2). Quantitative pigment spectrophotometry (Agilent Cary 60 UV-vis, Gear.) for the method, it is determined using the N.K. Lichtenthaler equation [8]

$$\text{Chl-a (mg/l)} = 13{,}36*A664 - 5{,}19*A649$$

$$\text{Chl-b (mg/l)} = 27{,}43*A649 - 8{,}12*A664$$

$$\text{C x+c} = (1000\ A470 - 2{.}13Ca - 97{,}63\ Cb)/209$$

$$F(\text{ mg/gr}) = (V*C)/P$$

In the formula: the pigment content (mg/gr) in the plant leaf is; V - volume (ml); C-pigment concentration (mg/l); plant tissue weight is.

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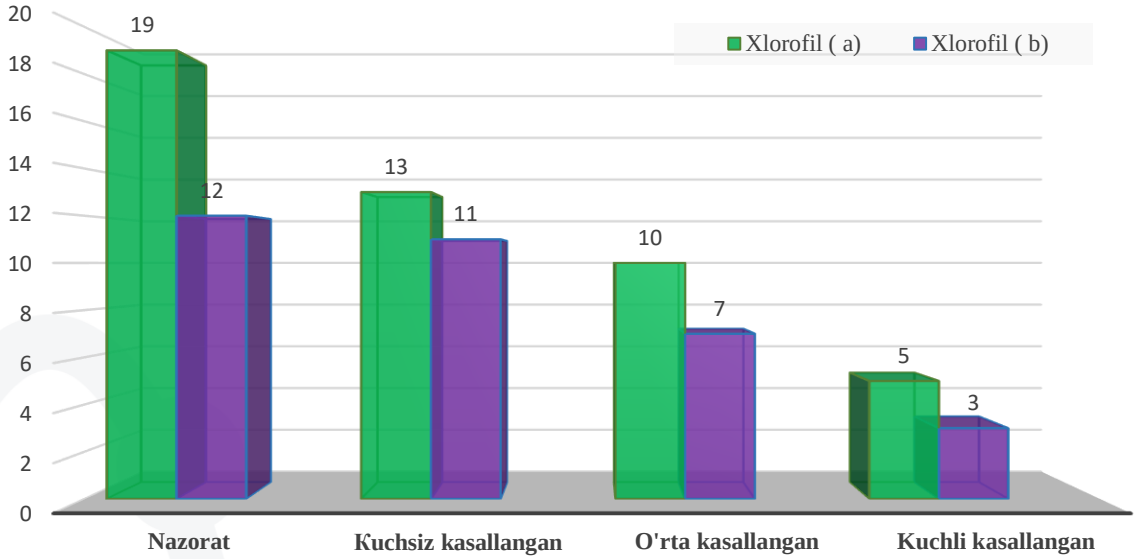
RESEARCH RESULTS AND THEIR DISCUSSION

Viruses are intracellular parasites and affect all living organisms to varying degrees, in most cases leading to disruption of the physiological processes occurring in them, as well as a decrease in productivity[2,5,6].

Therefore, one of the important issues is to study the degree of influence of the virus on some physiological processes in the plant during pathogenesis, including the amount of chlorophyll, which provides the photosynthesis process [1].



Picture.2. On bean leaves, healthy and to varying degrees infected with the virus, the amount of chlorophyll pigment

As can be seen from the graph, there was a decrease in the amount of both pigments as the incidence of the virus increased, including weak and moderately infected P. It was found that the amount of chlorophyll "a" in the leaves of the vulgaris plant in the control group was 19.68 mg/l, while in slightly infected plants it was reduced by 1.4 times compared with the control group, that is, to 13.25 mg/l.

However, in experiments it was found that a strongly infected leaf of the plant had a decrease of 3.8 times compared to the control group, that is, up to 5.0 mg/l. The virus had a very strong effect on the amount of chlorophyll pigment "B ", which is clearly visible in the diagram [2,3,7] (Picture.2).

CONCLUSION

In summary, according to the results of the experiment, it was found that in the leaf of a plant infected with BCMV to varying degrees, the chlorophyll content decreases by two times compared to the control, and in a plant strongly infected with the virus - by 4-5 times. The main mechanism of this process is that after the virus enters the plant cell, it begins to synthesize its parts.

This virus is considered an RNA-capturing virus, the self-synthesis of which depends on the activity of the reverse transcriptase enzyme. However, the MG element, which is the central element of chlorophyll, is necessary for the functioning of this enzyme. The extraction of this element from chlorophyll causes the destruction of the pigment, which leads to symptoms such as yellowing and paleness of the color of the leaves[4,6]. This requires broader scientific research to study the process in more depth. This, in turn, is considered important in managing the concentration of the virus and developing measures to combat it.

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