Mini Review

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How One Entomologist in the Middle of the 20th Century Gave the Direction of Photosynthesis Studies Which were Implemented in the 21st Century

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ABSTRACT

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There was once a wonderful person at the Kazan Agricultural Institute - Konstantin Ignatievich Popov. He was a disabled veteran of the Great Patriotic War, who figuratively and artistically told students about pests of agricultural plants. With each massive damage to crops, he was involved in finding out who the pest was? Once, while talking about damage to sugar beets, he could not find out which insect had damaged the leaves. And it was July, the heat was unbearable, he was very tired and sat down to rest on the ground in the field. And right in the audience sat on the floor. At the same time, with one hand, he leaned, and with the other he sorted out lumps of soil that fell under his arm. Suddenly, as he said, one of the lumps was not crushed. Looking, he saw a beet weevil. And he began to tell the students what kind of pest it is. This is how his lectures went. And all the students adored this teacher. While studying in my third year, I wanted to prepare my thesis with Konstantin Ignatievich Popov. And in the summer of 1959, on his instructions, I walked around the alfalfa field with an entomological net and determined the number and types of insects that came across, and the mass of alfalfa plants in this area. Meanwhile, my classmates participated in the haymaking. Indeed, a definite relationship was found between the number of insects and the increase in plant biomass. Konstantin Ignatievich invited me to his home to discuss these data. He lived in a separate one-story house in the courtyard of the main building of the KSHI. And through the window the territory of the Suvorov military school was visible, where the future officers were marching.

Konstantin Ignatievich showed me his huge thick album, in which, on one side, on each page, "US" was written at the top, and on the other side, "THEIR". And on the pages of "Them" there were clippings from newspapers and magazines about how everything is controlled (what varieties of plants, whether fertilizers were used in cultivation or not, what pesticides were used, etc.) in Western agriculture. And how all this is not done in the Soviet Union. So this entomologist, visiting fields damaged by pests, noticed that plants damaged by insects grew faster later. He made a proposal to include in the plan of his scientific work the preparation of a doctoral dissertation on this topic. The answer came from party organs that such a research topic would discourage agricultural workers. And there was a ban on such a topic of research. Then Konstantin Ignatievich accepted Yury Solomonovich Karpilov, a former graduate of the Kazan Agricultural Institute, as a postgraduate student and sent him to Kazan University, where I.A. Tarchevsky mastered the method of measuring photosynthesis using radioactive carbon 14C. But it so happened that as a result of the vigorous activity of N.S.

Khrushchev, a new plant was brought to agriculture in the Soviet Union - corn, as an important fodder crop. And Karpilov took corn as the object of his research.

But the very first measurements of the composition of the primary products of photosynthesis showed that corn produces completely different photosynthesis products compared to wheat Tarchevsky, 1958. The prospects for the discovery of a new way of photosynthesis stopped Karpilov's work on the topic of K.I. Popov. However, Popov's ideas gained ground. Colleague I.A. Tarchevsky from Sverdlovsk A.T. Mokronosov tested this idea on potatoes and found that a moderate reduction in leaf area actually increases their photosynthesis Mokronosov and Borzenkova, 1972. Moreover, a change in the mass of roots from the area of leaves on the plant was also noticed. However, the use of potatoes as the object of study, the main acceptor of photosynthesis products in which are tubers, did not allow researchers to draw correct conclusions about the level of regulation of photosynthesis. This topic also interested the German Lenz 1977. But to change the ratio between the leaf apparatus of the plant and the organs consuming the products of photosynthesis, he used the removal of flowers on the apple tree.

At the same time, photosynthesis was measured on the whole plant, and this changed the hormonal status of the plant, the connection with which was then difficult to grasp. At the same time, the Australians Hal and Brady 1977 carried out similar studies on pepper. They also removed the flowers. Both of them failed to create a convenient plant model for studying the very mechanism of endogenous regulation of leaf photosynthesis. All of them measured the intensity of photosynthesis and photorespiration, which is insufficient for understanding the regulation of the process *in vivo*. This requires the simultaneous measurement of photosynthesis, photosynthetic carbon metabolism, and transport of assimilates from leaves to consuming organs. This was done only in the homeland of K.I. Popov in Kazan at the Institute of Biology (and then Biochemistry and Biophysics) of the Kazan Scientific Center of the Russian Academy of Sciences. But this process was long and only after 40 years it was possible not only to discover the mechanism of regulation of photosynthesis and to combine into a single whole the processes in chloroplasts with the opening of stomata and with the conducting system of the leaf.

And then, under conditions with different levels of fertilizers, the regulatory relationship of leaves with other plant organs (especially with roots) was also clarified. Moreover, approaches have been found to control photosynthesis and ways to increase the root supply of trees in the fight against forest fires. But the main thing is that only the performer of these studies managed to realize this thanks to the previous stage of work under the guidance of the brilliant economist Professor Serafim Andrianovich Ilyin. He told the author of this letter many times: "There are no events without a cause. Look for the reason and you will understand the whole point. And we were constantly looking for more and more new indicators in order to establish why things happened in the economy this way and not otherwise. And there was an understanding of the whole phenomenon. Once I was present when Serafim Andrianovich accepted a guy to graduate school. It was his thirtieth graduate student. And finishing this conversation, he said to the graduate student: "So that by the end of the first year the dissertation should be written."

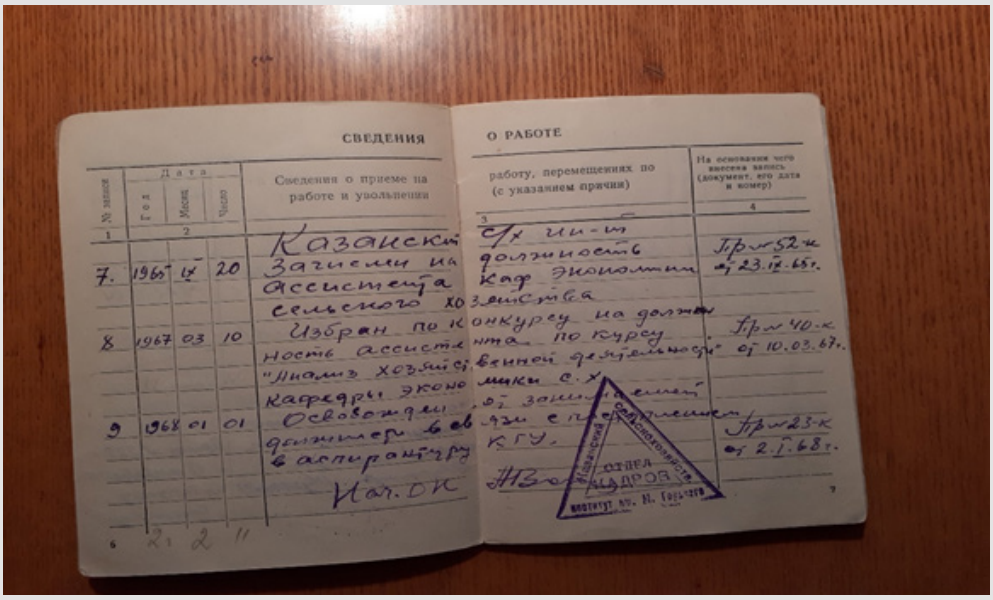

Figure 1.

After the graduate student left, I ask Serafim Andrianovich: "How is it? How can you write a dissertation in a year? And he answered me: "And if he can, let him write." But after he writes, wherever he learns something on this topic, he will immediately hasten to write this fact into his dissertation. And by the end of the third year, it will be ready." Like this. And as a result, all my further physiological and biochemical activity (50 years) was already under the auspices of economic ANALYSIS. It was on his initiative that S.A. Ilyin prepared the only course of lectures in the Soviet Union "Analysis of economic activity". And this name has been preserved as the only one for that time in the author's work book (see Figure 1).

Summary

Chikov Vladimir Ivanovich, Doctor of Biological Sciences, Professor of Biochemistry. Graduated from Kazan Agricultural Institute (KSHI) in 1961. He worked as an agronomist of the state farm (Tatar Republic). Then he participated in the development of an aircraft identification system (Friend or Foe) at the enterprise No. 416 and taught "Economics" and "Analysis of economic activity" at the KSHI. Since 1968, having entered the graduate school of KSU at the Department of Biochemistry, he was engaged in physiology and biochemistry of plants. In the 1990s, he taught three biochemical courses at the Faculty of Biology of Kazan University (KU): "General Biochemistry", "Bioenergetics" and "Photosynthesis". Participating in the competition for the "Soros Professor", received this title. Published more than 300 publications, of which 50 articles are related to the discovery of the mechanism of regulation of photosynthesis at the level of the leaf and the whole plant; on this basis, mechanisms have been developed to control photosynthesis by acting on the extracellular enzyme of the leaf with complex compounds (ammonia), and the mechanism of the occurrence of massive forest fires around the world has been discovered, and a method has been given to eliminate this phenomenon.

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