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# PLANT PHYSIOLOGY

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PLANT PHYSIOLOGY IN THE U.S.S.R.

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The extraordinary richness and variety of plant life on an enormous territory, embracing almost one-sixth of the land surface of the world, naturally impelled the Russian botanists first to direct their efforts to the study of the specific composition of its flora and of the geographic distribution of the plants. Classification and phytogeography were therefore the first branches of botany to be developed and still remain the predominant botanical disciplines in the U.S.S.R., both in the number of scientific specialists and in the amount of scientific research work accomplished.

Nevertheless, the beginning of plant physiology refers to the sixties of the last century, the founder of the first physiological school being A. S. FAMINTSYN (1835–1918), Professor of the St. Petersburg University and member of the St. Petersburg Academy of Sciences (since 1889). He published the first university text-book on plant physiology (1887) and a large monograph *Metabolism and transformation of energy in plants* (1883). His first pupils were BARANETZKY and BORODIN.

Plant physiology began to develop towards the end of the 19th and in the beginning of the 20th century, and there appeared consecutively the schools of C. A. TIMIRIASEV, V. I. PALLADIN, S. P. KOSTYCHEV, D. N. PRIANISHNIKOV, A. A. RICHTER, V. V. K. ZALESSKY, V. N. LUBIMENKO, N. A. MAXIMOV, N. G. KHOLODNY.

There was, however, an especially marked rise in the development of plant physiology after the October Revolution, which gave a great impetus to the organisation of new universities, high schools, botanical gardens, and large agricultural experimental institutions, wherein laboratories of plant physiology began to appear. Cadres of young physiologists of the new generation began to grow rapidly. In the Soviet laboratories they receive a complete special education. A great change is also to be observed in the general tendencies of research work. The old direction in plant physiology, as reflected in large handbooks and in text-books, in essence gave only a physico-chemical analysis of separate, unconnected functions of the organ-

ism; the organism as a living, dynamic, whole system was completely absent from them.

At the present time the attention of experimental workers is being more and more centered on the organism itself and on its proper internal factors, controlling all the physico-chemical reactions occurring within it. Consequently not only *phylogenetic variability* (manifesting itself in different species, races, and varieties, in connection with ecological adaptation to environment) is now taken into account even in ordinary biochemical investigations, but likewise *individual variability*, characterizing different stages of ontogenetic development.

The influence of each separate external factor on one or another reaction in the organism is not now studied by means of its simple isolation, as was the method formerly, but on the background of different combinations of other factors. As a result there has been produced an essential modification in our notions of the cardinal points, minimum, optimum, and maximum in physiological functions. They have ceased to be immovable points of a single curve; they have become dynamic, as a reflection of the dynamism of the organism itself, of the change in state of the protoplasm. The earlier investigations on photosynthesis (LUBIMENKO, KOSTYCHEV, L. A. IVANOV, and their collaborators, CHESNOKOV and BAZYRINA) have now given along this new line of investigation and study most interesting results in the works of A. C. DANILOV (the influence of light of different spectral composition), V. A. BRILLIANT (the influence of the water content of leaf tissue), A. K. TOSHCHIEVIKOVA and A. L. KURSANOV (the influence of the accumulation of assimilants in the leaf).

The same line of research is followed in the studies on frost resistance, heat resistance, drought resistance (N. A. MAXIMOV, I. I. TUMANOV, A. A. RICHTER, V. N. LUBIMENKO, and collaborators), on mineral nutrition (O. A. WALTER, D. A. SABININ and their collaborators), and on nitrogen nutrition (D. N. PRIANISHNIKOV and collaborators).

The problems of growth and growth movements have shown, after the old works of PORODKO, NELJUBOV, and ROTHERT, an exceptionally brilliant development in the works of N. G. KHOLODNY, who has together with WENT created the hormone theory of growth.

During the last ten years a special and most important place has been won by works on the physiology of development of the higher plants. GARNER and ALLARD's discovery of photoperiodism, and LYSENKO's discovery of the temperature yarovisation of seeds have served as a powerful impulse in directing research work along this path.

The favorable results in agricultural practice of the method elaborated by LYSENKO of the preliminary yarovisation of seeds have led to a wide development, in the greater part of the physiological laboratories of our

Union, of research work on the physiology of growth and development of plants. Attempts are now already being made of synthesizing all of the accumulated data into a theory of development (the most important theory of development-stages of LYSENKO, the hormone theory of LUBIMENKO, KHOLODNY, CHAILAKHIAN). Data have also been obtained for the practical application of photoperiodism in plant culture (the investigations of the laboratories of LUBIMENKO and MALCHEVSKI). An essential feature of the physiological research work of the present day is the choice of the problems studied. They all concern questions having the greatest practical significance for the agriculture and industry of the U.S.S.R. The necessity of such a choice of problems is the natural result of the necessity of replacing the empirics which formerly prevailed in industrial practice by methods scientifically elaborated and approved.

It is of course self evident that such an organization of work does not in the least exclude investigations of the most profound theoretical questions, which are studied in the laboratories of our academies and universities.

At the same time the socialistic structure of the whole economy of the U.S.S.R. guarantees a very speedy penetration into practice of valuable scientific attainments and discoveries. The following may be cited as an example: LYSENKO began to apply his method of preliminary yarovisation of seeds to field cultures in 1931, and already millions of hectares are being sown with yarovized seeds.

In conclusion I wish to emphasise that the high estimation of scientific research work, both by the Government and by society, create in the U.S.S.R. most favorable economic and moral conditions for scientific work and fully guarantee the development of science in general, and of plant physiology in particular.

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