

## **PLANT PHYSIOLOGY AND BIOCHEMISTRY IN THE REPUBLIC OF MOLDAVIA CONCLUSIONS AND PERSPECTIVES**

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In the Republic of Moldavia Plant Physiology and Biochemistry began to develop as an academic science in the middle of the 20<sup>th</sup> century when the experimental base of the USSR Academy of Sciences was founded in Chișinău, the scientific researches and the contribution of the scientists of the preceding years being the base for it. The Department of Plant Physiology and Biochemistry founded afterwards at the Moldavian Branch of the Academy of Sciences of the former USSR comprised two laboratories: the laboratory of Plant Physiology and that of Plant Biochemistry. Scientific investigations were carried out on the vine plant frost resistance; the vine and fruit plant growth and fructification processes; the agricultural crops physiologic diseases; the physiologic foundation of seed treatment before sowing. During that period of time 30 vine homologated varieties were characterized concerning their frost resistance; certain advanced cultivation technologies were elaborated; the physiologic basis for seed treatment of thermophile plants with low temperatures aimed at productivity increase was proved scientifically.

The biochemical researches dealt with the study of agricultural yield quality depending on the biological peculiarities, ecologic conditions and cultivation technology. Fruit chemical structure during preservation as well as biosynthesis validities and substance metabolism determining the increased indices of preservations capacity were studied.

At the beginning of the 60-s the organizational stage of researches on plant physiology and biochemistry ended. There were highly qualified staff and the necessary technical-material basis for carrying out and proving scientifically the researches. A number of scientific works aimed at solving urgent problems in the national agriculture were carried out during that period of time. Thus, during the period between 1946-1961 there were obtained substantial scientific results concerning plant physiology and biochemistry, these being appreciated by the researchers of other scientific centers.

The foundation of the Institute of Plant Physiology and Biochemistry in 1961 was of special importance for the development of the science about the vital plant processes, the Institute becoming the leading and coordinating center of those researches. The main directions of studies were: the study of the photosynthesis process as a factor of productivity increase; the elaboration of physiological-biochemical basis of the productivity of the vine plants, fruits and technical plants as well as cereals depending

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on mineral nutrition, water supply (conditions) and the abiotic environment factors in order to increase resistance; the study of biosynthesis validities of carbon hydrates and proteins in plants. To cope with these tasks the following laboratories were organized at the Institute: the nutrition physiology, the plant growth and development, laboratory together with those of the resistance physiology, hydric exchange photosynthesis, biochemistry, and phytopathology.

An important contribution to the development of the applied physiologic aspect was made by the foundation of the Academy Experimental Station which was incorporated into the Institute of Plant Physiology and Biochemistry in 1970. In 1991 the Institute was renamed into the Institute of Plant Physiology in view of the fact that the concept and the directions of researches had been changed.

During that period of time at the Ministry of Agriculture Research Institutions there were founded laboratories studying the physiology and biochemistry of new agricultural plant varieties to be included in advanced technologies.

At the Republic University of Agriculture Studies, Pedagogical and State University there were special programs at the chairs of Plant Physiology for the study of physiological-biochemical processes. At the State University of Chişinău they started to train specialists in the domain of Plant Physiology and Biochemistry.

Valuable results in studying the physiology of plant resistance to environment unfavorable factors were obtained by the researchers of the Republic Academy Institute of Plant Physiology. There were carried out investigations to elucidate the factors determining resistance, there were elaborated methods to diagnosticate and to regulate resistance as well as agricultural plants productivity.

At that time scientific researches at the Institute were aimed at making evident the physiological-biochemical mechanisms for exogenous regulation of the adaptational potential, for increasing plant resistance and productivity under the conditions of concentration and specialization of agroindustrial yield, for the elaboration and implementation of advanced technologies that made it possible to reduce phytotechnique products transportation and preservation losses.

But the technical-scientific progress generated a number of negative ecological phenomena, such as diminution of genetic background, accelerated exhaustion of natural resources, intensification of pressure upon nature that led to environment pollution, to continuous decrease of agricultural plants productivity and quality. These phenomena are characteristic of Moldavia in particular where on the of fertile soils and under favorable solar radiation plant productivity is determined to a great extent by their resistance to the destructive action of the elements of the hydrothermic conditions of soil and air that are characterized by a number of specific peculiarities (high and low temperatures, drought, erosion, soil salification etc.), their action leading not only to yield decrease but often to its total loss. Under these conditions the traditional agrotechnologies aimed at selecting regional high productive varieties are not efficient enough. All these factors conditioned

the necessity of fundamental scientific researches aimed at elaborating a new level of the general theory of the production process under unfavorable climatic conditions. The elaboration of this theory gives new possibilities to formulate physiological-biochemical and morphofunctional models necessary for the improvement of plant resistents to unfavorable factors, elucidate the theoretic basis for the prognostication and regulation of the plant resistance and productivity; to promote new concepts, hypotheses, methods and technologies for obtaining maximum harvests under the given environment conditions by minimum energy and material consumption.

These strategic plants can be out as a result of fundamental studies aimed at investigating: the regulation and integration systems of physiological, biochemical and structural processes at various levels of the vegetal organism organization peculiarities of subordination and integration of photosynthetic and energetic systems, the ways of functional systems transformation which determine the assimilates transportation and utilization during growth and development processes in connection with the organization and regulation of "donor-acceptor" and "immune-protect" regulations; organization and regulation of genome expression; the functions of cell membranes and organized as well as their interdependence; energy, substance and information fluxes in various cell systems and the entire vegetal organism.

Concerning the facts mentioned above, during the previous years the Institute of Plant Physiology of the Academy of Sciences of Moldavia carried out fundamental and applied investigation on plant ontogenesis in order to elucidate the reactions and processes concerning growth and development regulation, physiological-biochemical peculiarities of plant resistance to unfavorable factors to elaborate methods for controlling the relations between plant and environment. The peculiarities revealed contribute to the further solution of fundamental and applied problems of plant physiology and biochemistry concerning the expression of plant resistance and productivity potential depending on the action of unfavorable factors, the importance of various systems in realizing the production process, elaboration of new methods, methodologies for the prognostication and increase of plant productivity and resistance.

In spite of the difficult economic situation of our country, at present the Institute of Plant Physiology comprises 12 laboratories and has on its staff 220 people, among them there are 70 scientific researches - 4 academicians, 1 corresponding member, 3 researches having got the title "Honoured Scientist", 13 habilitate doctors (doctor professors), 40 doctors of sciences. Dealing with the problems of Plant Physiology and Biochemistry they have elaborated certain laws of physiological, biochemical and structural processes depending on plant resistance to drought, low and high temperatures and other unfavorable environment factors that permit theoretic substantiation of prognostication and regulation of plant resistance and productivity. There were developed new concepts and hypothesis: the regulation role of the microelements concerning plant metabolism, productivity and resistance (academician S. Toma); the coordinating role of donor-acceptor relations in the regulation processes of plant photosynthetic productivity

resistance (corresponding member C. Moraru); the regulation function of energetic exchange (habilitate doctor N. Balaur); new notions have been formulated: organspecific biontity, carpbiont, carpculture (academician B. Matienco). There were obtained new results concerning: stratification and vernalization processes marked by certain polypeptide (habilitate doctor A. Dascaliuc); the critical thresholds of vine plant hydrothermic stress-factor and peculiarities of adaptation reactions to excessive humidity conditions (doctor P. Negru); activation of certain autoregulating systems and processes of water exchange under hydric and thermic stress conditions (doctor A. Chirilov, habilitate doctor A. Shtefirtsa); optimization of growth and development processes, yield and plant resistance increase, disease combating and fruit preservation by administrating biologically active substances (academician I. Popushoi, habilitate doctor M. Atimoshoae, doctor Gh. Balmush, doctor of technology N. Bajureanu).

On the whole, the results obtained have stimulated fundamental researches at the level of systems regulating plant viability and they were reflected in the formulation of the main theoretic and applied researches for the period between 1996-2000.

At present, on the basis of the investigations carried out there are developed new methods for the regulation and prognostication of plant resistance to frost and drought as well as fruits preservation:

- recommendations concerning placement of vine plant varieties depending on their drought and frost resistance as well as on the granulometric soil composition;
- model for diagnosticating apple fruit preservation capacity in the united system "cultivation-preservation";
- recommendations concerning administration of growth regulators of natural origin in the plantations of apple trees of tardy varieties;
- recommendations dealing with the use of microelements and biologically active substances to increase the yield, preservation quality and capacity of tardy fruits;
- new procedures to regulate plant frost and drought resistance by administrating ubichione;
- procedures for testing wheat genotypes, biologically active substances depending on frost, drought and intense heat plant resistance;
- procedure to increase plant resistance and productivity by treating the seeds with biologically active substances (Vinur, Fitostim, CMC);
- method for exogenous regulation of thermophile plant resistance by utilizing coordonative compounds;
- method for regulating the development of vine plant graft buds;
- new substances for preventing from chlorosis;
- sophisticated apparatus for registering plant physiologic and biochemical indices under vegetation conditions with modern mathematical foundation for their processing.