

R E P O R T

by Prof. Antoaneta Vidolova Popova, PhD

Institute of Biophysics and Biomedical Engineering-BAS

of **Doctor of Sciences Thesis in the professional field 4.3 Biological sciences, scientific specialty Plant Physiology**

Author: Prof. Violeta Borisova Velikova, Institute of Plant Physiology and Genetics, BAS

Subject: "Physiological role of biogenic isoprene in plants"

General presentation of the procedure and dissertation

The presented set of documents is accomplished according the requirements of the Law for Development of Academic Staff of Republic of Bulgaria, staff regulations of BAS and rules for development of academic staff of Institute of Plant Physiology and Genetics, BAS (IPPG-BAS). Scientific indicators of Prof. Velikova meet the National requirements for achievement of academic degree **Doctor of Sciences**.

In 1986 Prof. Velikova got her Master degree in Ecology and Environmental Protection in Biological Faculty of Sofia University. In 1988 got a position of specialist in Institute of Plant Physiology of BAS (IPP-BAS). In 1998 had defended a PhD thesis „**Influence of artificial acidic rain on the functional activity of photosynthetic apparatus and opportunities to overcome its adverse impact with the help of polyamines**”. In 2006 was promoted as an associate professor (IPP-BAS) and in 2012 was elected as a professor in IPPG-BAS. At the present moment Prof. Velikova is leader of Laboratory „Photosynthesis-activity and regulation” in IPPG-BAS. Prof. Velikova was a supervisor of two PhD thesis, defended in 2016 и 2017. Prof. Velikova is a co-author of 102 papers, 74 in international journals, refereed in WoS/SCOPUS and with IF. According to the classification of Journal Citation Reports (JCR) of Web of Science of scientific journals with IF the 74 publications of Prof. Velikova are grouped as follows: Q1 – 43, Q2 – 9, Q3 – 20, Q4 – 1. The published papers had been cited more than 4000 times according to WoS/SCOPUS, h index (Scopus) – 25 and the total IF – 190.489. The scientific results had been presented in 72 scientific meetings in the period 1990 - 2019. Prof. Velikova was the principal investigator of a lot of national and international scientific projects, a holder of specializations (Great Britain, Italy, Portugal, Greece) and a holder of international fellowships (Alexander von Humboldt,

Marie Curie, NATO). She is a member of Union of Scientists in Bulgaria, Federation of European Plant Biology Society (FESPB), Society of Experimental Biology (SEB). Since 2014 Prof. Velikova is the Chairman of the Scientific Council of IPPG, BAS.

The presented thesis is based on 20 published papers (Q1-19, Q2-1) with a common IF 86.85, that had been cited 1327 by other scientists. Lists of published papers, citations and quartiles of the journals are presented. Prof. Velikova is the first author of 13 publications, the second one of 1 and the last one of 2.

State of art

The presented thesis is a summary of the long lasting research of Prof. Velikova with the main goal to unravel the physiological role of biogenic isoprene for enhancement sustainability of plants towards abiotic stress (treatment with ozone, singlet oxygen, high temperature, high level of CO₂, desiccation, anthropogenic contamination, heavy metals). Isoprene is the most widespread biogenic volatile hydrocarbon gas and because of its high reactivity plays an important role in atmospheric chemistry, air quality and climate change. For the synthesis of isoprene plants invest significant resources such as ATP, NADPH and fixed in the process of photosynthesis carbon and these costs are significantly increased under stress conditions, suggesting that the synthesis of isoprene is related to defense system of plants that protects them from abiotic stress. The influence of biogenic isoprene on the quality of air and the climate change, stress-induced isoprene emission and its protective role of sustainability of photosynthetic process towards environmental stress conditions makes the investigations of isoprene production and its effects on functional activity and structural organization of plants and on atmospheric chemistry up-to-date.

Characterization and assessment of the thesis and applicant

The main research goal of the thesis is: **Assessment of the physiological role of biogenic isoprene as a means for protection of plants against abiotic stress. Three main hypothesis** are proposed and **four tasks** are formulated.

The **overview** of published up to now reports gives a comprehensive description of the factors that control and regulate the isoprene emission, with special attention being paid to the role of biogenic isoprene in the protection of plants from abiotic stress.

In the section **Approaches and Methods of Investigation** a detailed description is given of the approaches used to achieve the assigned tasks. Adequate, diverse and up-to-date

physiological, biochemical and biophysical methods, proteomics and lipid analysis, electron microscopy, Blue-Native PAGE, GC-MS, HPLC and etc. are applied.

In the section **Results and Discussion**, in seven sub sections, are presented and discussed the results and evidences supporting the ability of biogenic isoprene to increase plant resistance to environmental stress factors and **three hypotheses** are suggested that can explain the mechanisms of action of isoprene. Evidences has been given that biogenic isoprene reduces stress-induced oxidative stress in plants and results are reported proving its contribution to the changes in the organization of photosynthetic membranes in terms of lipid and protein composition. Facts about the correlation of the amount of emitted isoprene and the level of the main classes of photosynthetic lipids are presented. A mutual relationship between the amount of emitted isoprene and other metabolites has been established that results in better plant protection under stressful conditions, as well as the relationship between biogenic isoprene and anthropogenic contamination of the environment. For the first time a scheme of the participation of isoprene in the overall antioxidant system of plants was proposed that provides more effective protection against abiotic stress.

From the correct presentation and discussion of the results 15 contributions are derived that summarise the up-to-date new scientific information.

The application of the wide range of diverse and up-to-date methods of research and the correct interpretation of the results obtained and the high attention obtained of the published results shows the high scientific expertise of Prof. Velikova and high scientific value of established new scientific facts and of the thesis.

The **summary** in a volume of 78 pages correctly describes and presents the content of the thesis. The main goal, hypothesis and tasks, the 15 contributions, a list of published articles on which the thesis is based and information about the number of papers that cite the publications of Prof. Velikova are included. Information about the financial support of the long-lasting research by national and international projects and individual scholarships is also provided.

Conclusion: The presented thesis is a summary of a serious research investigation of the **Physiological role of biogenic isoprene in plants**, resulting from the long-standing work of Prof. Velikova. New scientific facts have been presented regarding the contribution of isoprene for increasing plant tolerance to abiotic stress and for alterations in plants on

functional, proteomic, metabolic and structural level. The thesis meets all requirements of the Law for Development of Academic Staff in Republic of Bulgaria, the rules of BAS and the rules for development of academic staff of IPPG-BAS. The naukomettic indicators of Prof. Velikova completely cover the national requirements and criteria for acquiring the scientific degree "**Doctor of Sciences**".

The **thesis** represents a complete up-to-date scientific investigation and demonstrates the high scientific expertise of Prof. Violeta Velikova, qualities and skills for conducting research and obtaining original and significant scientific contributions. All this gives me a reason to give a positive assessment of the presented results and formulated contributions in the **thesis** and to offer to the respected members of the scientific jury to award the scientific degree "**Doctor of Sciences**" of Prof. Violeta Borisova Velikova in the field of higher education: **professional field 4.3 Biological sciences, scientific specialty "Plant physiology"**.

13.03. 2020 г.

Assessor

Prof. Antoaneta Popova, PhD

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