

REVIEW

for the competition for the academic position of "professor", announced in SG No. 12 / 09.02.2024, in the field of higher education 4. Natural sciences, mathematics and informatics; professional direction 4.3. Biological Sciences; scientific speciality Plant Physiology, for the needs of the "Regulation of plant growth and development" laboratory at IPPG-BAS

Candidate: Associated Professor Iskren Georgiev Sergiev from IPPG-BAS

Reviewer: Prof. Dr Andon Vassilev Andonov, Agricultural University of Plovdiv, field of higher education 4. Natural sciences, mathematics and informatics; professional direction 4.3. Biological Sciences; scientific speciality Plant Physiology, appointed by Order of the Director of IPPG-BAS № RD-01-15 / 02.04.2024 г.

1. General data on the candidate's career and thematic development

Iskren Georgiev Sergiev completed his higher education in 1991 at the Faculty of Biology of the Sofia University "St. Kliment Ohridski" with a Master's degree in "Biochemistry and Microbiology" and specialization in "Plant Physiology". In 1995, he entered full-time doctoral studies at IPPG-BAS under the supervision of Academician Emanuil Karanov, and in 1998, after successfully defending his dissertation on the topic: "Cytokinin antagonists - structure-activity relationship and some physiological properties", he obtained the ESD "Doctor" in the scientific specialty "Plant Physiology".

His entire working experience (over 32 years) was spent at IPPG-BAS, where he successively held the positions of specialist biologist (1991-1995 and 1998-1999), research associate (2000-2006) and senior research associate (2006-2010), and after the changes in the positions in the scientific units – associated professor (2010-present).

The scientific interests of associate professor Dr Iskren Sergiev logically coincide with the main theme of the laboratory "Regulation of Plant Growth and Development" where he works. They cover a wide range of topical issues, but are most closely related to studying the properties and role of phytohormones and synthetic growth regulators in the physiological response of plants to various stress factors.

The candidate's scientific research over the years covers the following questions (1) physiological and herbicidal effects of new growth-regulating substances, (2) acclimation metabolic changes in plants under stress conditions and (3) protective influence of cytokinins, auxins and various growth regulators on plants exposed to environmental stressors.

The candidate's research was conducted in teams with scientists from IPPG-BAS and other scientific institutes at the BAS, from the country and abroad (Lithuanian Academy of Sciences) and was financed mainly through competitively won projects (NSF, INCO-Copernicus program of the EU, etc.).

Associate Professor Dr. Iskren Sergiev is a member of the Union of Scientists in Bulgaria and the Federation of European Societies of Plant Biology (FESPB). He is fluent in English and Russian, has high computer skills and a number of other competencies. During the years of his early career, he specialized in leading scientific centers in Europe (Istituto

biosintesi vegetali – CNR, Milano, Italy; University of Antwerp – Belgium, etc.). He is a member of the Editorial Board of the scientific journal *Botanica* (Q4) since 2022. He is a reviewer of a significant number of scientific publications in international scientific journals.

2. Evaluation of the submitted reference for compliance of the applicant's scientometric data with the minimum and specific requirements in the regulatory documents

Associate Professor Dr Iskren Sergiev has presented a complete list of his scientific works, which includes 89 works. From them, he has selected 21 scientific papers for participation in the competition - 18 scientific publications indexed in SCOPUS and Web of Science, and 3 book chapters that were not included in previous procedures for scientific degrees and academic positions. All submitted candidate articles are collectively co-authored.

The reference of compliance was prepared according to the requirements of Art. 26, para. 1 of the LDASRB (Law on the Development of the Academic Staff in the Republic of Bulgaria) and Appendix 1 of the Regulations on the specific conditions and order for acquiring scientific degrees and for holding academic positions at the IPPG-BAS. The scientometric data of the candidate are presented separately for each group of indicators (A, B, C, D, D and E) and are valued correctly according to the approved point system. The results of the compliance check for the specific groups of indicators are as follows:

Group of indicators A – 50 points, which are in accordance with the norm of 50 points for a defended doctoral dissertation.

Group of indicators B – 0 points (not required)

Group of indicators C – 107 points with a minimum requirement of 100. The group presents 5 scientific publications, 3 of which are with quartile Q1 (75 points), 1 with quartile Q2 (20 points) and 1 with quartile Q4 (12 points). The total IF of the articles is 10,225. In this specific case, there is compliance not only with regard to point requirements, but also with regard to the general issue of the publications (herbicide stress), which according to Art. 29, para. (1), item 3 of the LDASRB are equivalent to habilitation work.

Group of indicators D – 287 points with a minimum requirement of 220. The points of the candidate for the first and corresponding author are 135, which fulfills the specific requirement in the IPPG-BAS for a minimum of 110. 13 scientific publications (242 points) and 3 book chapters (45 points) are presented. Four of the publications were in Q1 (100 points), 4 in Q2 (80 points), 3 in Q3 (40 points) and 2 in Q4 (22 points). The total IF of the publications is 16,156.

Group of indicators E – 2610 points with a minimum requirement of 200. Evidence of 1310 citations (without self-citations) of the candidate's publications in the SCOPUS and Web of Science databases for the last 7 years (sample from the SONIX Database) is presented. 51 scientific publications of the candidate from his general scientific production have been cited, including citations of his works in the current competition.

Group of indicators E – 160 points with a minimum requirement of 150. The candidate's points in this group of indicators are formed by the management of 1 national scientific project - KP-06-H66/7 (20 points) with significant financial resources attracted for IFGR (40 points), participation in 1 international - DOO2-37 (20 points) and 8 national scientific projects (80 points). The IPPG-BAS's specific requirement for 1 successfully defended doctoral student - Dr. Irina Moskova, to whom the candidate is a scientific consultant, has been fulfilled.

On the basis of the indicated information, I consider that there is complete correspondence between the scientometric data of Dr. Iskren Sergiev and the requirements for all groups of indicators in the normative documents. At the same time, it is necessary to note that the total number of points of the candidate - 3224 significantly exceeds the minimum requirement of 720 and is due to the high number of citations.

3. Analysis of the main directions in the candidate's research work and the most important results and contributions

The author's reference for the contributions from the research activity of Dr. Iskren Sergiev was prepared according to the specific requirements in the Regulations of the IPPG-BAS. It begins with a brief introduction to the central scientific problem in the candidate's research activity - the role of phytohormones and growth regulators in plants under norm and stress, followed by a definition of 4 main scientific directions with an indication of the scientific works related to them. Next, the most important results in the individual areas are noted and the personal contribution of the candidate in each of them is specifically described.

I accept the reference, but I think that the areas mentioned overlap and can be combined and presented in a reduced number. Based on the candidate's declared participation in all stages of research - from the formulation of ideas and hypotheses to the practical implementation of analyzes and the preparation of scientific articles, I believe that his personal contribution to the presented publications is substantial.

The most significant results in Dr Sergiev's research, which in my opinion have the character of original scientific contributions, are the following:

The **first direction**, which for brevity I will formulate as "Modulation of herbicide phytotoxicity", refers to the studies included in publications No. 1, 4, 6, 7, 11, 20, 21. They indicate the effects of pretreatment with chemical substances (hydrogen peroxide, cytokinin 4PU-30) on the degree of herbicide (glyphosate, paraquat) phytotoxicity (publ. 1, 4, 6, 7), the dependence of the physiological status of herbicide-treated plants on the type of subsequent abiotic stress (drought, waterlogging) (publ. 20, 21) etc. I consider the results demonstrating the protective effect of pretreatment with the phenylurea cytokinin 4PU-30 against phytotoxicity by the herbicide glyphosate in maize plants to be an original contribution. I also accept as an original scientific contribution the established different plasticity of the photosynthetic apparatus of young wheat and triticale plants, treated with the herbicide Serrate, upon subsequent drought and waterlogging.

In the **second direction** "Modulating effect of synthetic auxins in the formation of the physiological response of plants to abiotic stress" are included studies presented in publications No. 13, 14, 16, 17 and 19. In them, the effect of pretreatment of peas and other plants was studied with structural analogues of naphthylacetic acid (TA-12 and TA-14) against herbicide (Glean-75, glyphosate, 2,4-D) (publ. 16, 17), high temperature and osmotic stress (publ. 13, 14, 19). In my opinion, the original scientific contributions of these studies are the established protective effects of the two auxin analogues, as well as their proven specificity towards antioxidant and detoxifying enzymes (glutathione reductase and glutathione-S-transferase, respectively) in herbicides with different mode of action.

Scientific results of the **third direction** "Induction of stress tolerance in plants by means of natural and synthetic growth regulators" are presented in publications No. 5, 9, 10, 12, 15 and 18. A central place in this group of studies is occupied by experiments and reviews on the role of polyamines as part of the endogenous defense system of plants (publ. 5, 9, 10 and 12). I consider the proven positive influence of natural and synthetic aliphatic polyamines (mainly diethylenetriamine) on the tolerance of wheat plants to low-temperature stress to be a contribution of a scientific and scientific-applied nature (publ. 9). Here, the research on the effect of pretreatment with cytokinin (4PU-30) and retardant (MEIA) and the application of higher aliphatic alcohol (Triacontanol) on tomato and pepper disease caused by TSWV (Tomato spotted wilt virus) is also included (publ. 15, 18). I appreciate the results showing a positive effect of the applied substances on the degree of the viral disease as a contribution of a scientific-applied nature.

Publications 2, 3 and 8 refer to the **fourth direction** "Interaction between natural and synthetic growth regulators in *Arabidopsis* under normal and stress conditions". They compare the responses of two types of *Arabidopsis* (the ethylene-insensitive mutant *eti5* and the wild-type *Arabidopsis* Columbia) to temperature effects (publ. 3 and 8) and application of anticytokinins (publ. 2). I accept as a scientific contribution the established dependence between the higher temperature tolerance of the ethylene-insensitive mutant *eti5* with the higher constitutive levels of polyamines in it and with the better redox status compared to those in the wild type, as well as the fact that the applied high-temperature stress affected the polyamine content of these cold-tolerant plants to a greater extent than the low-temperature stress. Another scientific contribution of the comparative studies with the two types of *Arabidopsis* is the proven anticytokinin effect of new structural analogs of the cytokinins BA and 4PU-30 through the weaker arresting effect on leaf senescence and correlation with changes in total ribonuclease activity.

3. Scientific problems of the candidate, their significance for science and society and prospects for future research

The research of Dr. Iskren Sergiev has a clearly defined central scientific problem - regulation of plant growth and development and their tolerance to stress factors. In fulfillment of this goal, he conducts research on the influence of phytohormones and growth regulators on the physiological status of plants grown in normal and stressed conditions. The object of

research in his experimental activity are various plant species - peas, wheat, triticale, corn, tomatoes, pepper, as well as the model plant *Arabidopsis thaliana*, grown in normal conditions or subjected to various types of stress (herbicides, drought, waterlogging, low and high temperatures, UV-C, etc.). Research includes a wide arsenal of modern biochemical, physiological and other analytical methods.

I believe that the candidate's scientific issues are increasingly relevant for science and society. In the present conditions of climate change, environmental pollution and a growing world population with limited land resources, the issue of food safety is an undisputed priority. The possibilities to limit the losses of crop production from various stress factors and to increase the yields of agricultural crops are closely related to a better understanding of the self-regulation of physiological processes in plants and finding practical opportunities for their modulation. In a more concrete way, I would like to point out that Dr Sergiev's research on the possibilities of ameliorate herbicide phytotoxicity by means of exogenous substances has not only theoretical, but also important practical significance. Manifestations of herbicide phytotoxicity occur frequently in practice due to technological errors, combining herbicide treatments with unsuitable climatic conditions, application (drift) of herbicides on non-target crops, etc.

Proof of the relevance of Dr Sergiev's scientific topics is the significant number of citations of his works in the scientific literature. The total number of citations of all the candidate's scientific works exceeds 2700. His active participation in scientific forums also contributes to the high interest in the candidate's research. For the last 6 years (2018-2024), he has participated with 3 reports and 25 posters in 16 scientific forums at home and abroad.

The candidate's planned future research is a logical continuation of his research activity. These will include studies on (1) different combinations of herbicides and growth regulators in different plant species under stress conditions, (2) the modulation of crop stress tolerance by natural and synthetic regulators and other substances, and (3) the use of mutant forms of the model plant *Arabidopsis thaliana* for studies on hormonal regulation and interactions between phytohormones and endogenous and exogenous growth regulators.

4. Organizational and training activity

Dr. Iskren Sergiev is involved in the training of young scientists, which is an important criterion for career growth. He conducted a doctoral course on "Natural and synthetic growth regulators" at the BAS Training Center, in which 5 doctoral students took part. As it was already noted, he was a scientific consultant to a PhD student who successfully defended his free training - Dr. Irina Moskova.

Dr Sergiev has good organizational skills, evidence of which is his participation in the organization of a number of scientific forums in the country. He was the chairman of the organizing committees of the International Scientific Conference "Responses of Plants to Environmental Stresses", May 12-18, 2008 in the city of Elena, the International Scientific Working Meeting "Sustainability, Stress and the Bases of Plant Resistance", September 8,

2006 in Sofia as well as is a regular participant in the organization of various scientific events of IPPG-BAS.

5. Critical notes and recommendations

I have no critical remarks, but I have 2 recommendations for the candidate.

1. To include in the experimental designs of his subsequent studies variants with stress effects or treatments of plants in a later phase of growth and development, which will increase not only the scientific, but also the applied value of the obtained results.
2. To include in its research program protective products from the group of biostimulants (for example, algae extracts with high hormonal level). The use of these products in agriculture is constantly increasing, but research on their mechanisms of action on plants is not sufficiently studied.

Conclusion

After thorough acquainting with the presented materials and scientific works and analysis of the results and scientific contributions, I express my positive opinion regarding the candidacy of Associate Professor Dr. Iskren Sergiev for the announced academic position. The candidate participates in the competition with a sufficient number of scientific works published in authoritative scientific journals, and evidence of accompanying scientific activities that fully meet the requirements of the LDASRB and the Regulations on the specific conditions and order for holding academic positions at the IPPG-BAS for the occupation the academic position of "professor".

Associate Professor Dr. Iskren Sergiev has a clear scientific profile in one of the most interesting areas of Plant Physiology - the regulation of plant growth and development. The candidate's works contain original scientific and scientific-applied contributions with the potential for application in practice.

Bearing in mind what has been stated so far, I am fully convinced to give my positive assessment and recommend to the Scientific Jury to prepare a report-proposal to the Scientific Council of IPPG-BAS for election of Associate Professor Dr. Iskren Georgiev Sergiev to the academic position of "Professor" in professional direction 4.3. Biological Sciences and scientific specialty "Plant Physiology".

Reviewer:

21.05.2024.

Plovdiv

/Prof. Dr Andon Vassilev/