R E V I E W R E P O R T

on a competition for the academic position “Associate Professor” in a professional field 4.3. **Biological Sciences**, scientific specialty ”**Plant Physiology**”, announced in SG № 22/15.03.2024, for the Laboratory "Regulators of Plant Growth and Development", Institute of Plant Physiology and Genetics – Bulgarian Academy of Sciencies (IPPG-BAS)

*Candidate:*D-r **Zornitsa Katerova-Landzhova**, PhD, Assistant Professor in the Laboratory "Regulators of Plant Growth and Development", IPPG-BAS

Reviewer: Associate Professor **Irina Ivanova Vaseva**, PhD, Laboratory “Regulation of Gene Expression”, IPPG-BAS

Dr. **Zornitsa Katerova-Landzhova** is the only candidate for the announced competition. The presented documents for participation in the procedure are prepared according to the legal requirements and are in line with the Regulations for acquiring scientific degrees and holding academic positions at IPPG-BAS.

1. Scientific career

Dr. Zornitsa Katerova-Landzhova obtained her Master of Science degree in "Biotechnological Processes and Devices" with a specialization in "Industrial Biotechnologies" at the Faculty of Biology of Sofia University "St. Kliment Ohridski" in 1999. In the period 2002-2008, she became a Ph.D. Student at the Institute of Plant Physiology "Acad. M. Popov" – BAS, and worked on her Thesis "Physiological and biochemical changes in pea plants irradiated with UV-B and UV-C". The doctoral studies were carried out under the supervision of Academician Emanuil Karanov, and Prof. Lyubomir Iliev acting as scientific advisor during the final pre-defense phase. For her excellent doctoral work, Dr. Katerova-Landzhova was awarded a Diploma by FNTS, VAK and SUB in the "Competition for Scientific Achievements of Doctoral Students – 2008".

After obtaining her doctoral degree, she continued her work in the restructured research unit Institute of Plant Physiology and Genetics (IPPG) within the Academy as an Assistant Professor. For more than 16 years, she has been part of the "Regulators of Plant Growth and

Development" team at IPPG – BAS. Her research work focuses on the physiology of stress in various types of economically important crops.

In the course of her professional development, Dr. Katerova-Landzhova acquired significant international experience, carrying out several specializations abroad. While still a student at Sofia University “St. Kliment Ohridski”, she obtained a scholarship funded by the TEMPUS program. This allowed her to work at the University of Ghent (Belgium), in the Laboratory of Industrial Microbiology and Biocatalysis at the Faculty of Agricultural and Applied Biological Sciences. The topic of the project she was involved in was "Metabolic Engineering in *E. coli*: Effect of *aceA* and *acnA* Genes on Acetate Production".

In the period 2003-2004, she carried out a 10-month doctoral specialization under the international cooperation program between Bulgaria and FWO in the Laboratory of Plant Physiology and Biochemistry at the Faculty of Biology of the University of Antwerp (Belgium). There she worked on a research project related to the effects of Cd stress and UV light on the levels of certain phytohormones.

Her next international work appointment (2013-2016) was at the National Agriculture and Food Research Organization, Sapporo and Tsukuba, Japan. She was a Postdoctoral Fellow of the Japan Society for the Promotion of Science. There she studied the regulation of flowering time and control over the number of stem branches in Arabidopsis with the participation of nuclear poly(A)-binding proteins (PABN).

Besides her research work, Dr. Katerova-Landzhova actively participated in organizational activities as a member of a Commission for updating the “Rules for the Structure, Activities and Internal Regulations” of IPPG. She served as the Technical Editor of the scientific journal "Genetics and Plant Physiology" published by the Institute.

2. General research metrics

The candidate participates in the competition with a total score of **836** points, which significantly exceeds the required minimum of 540. The presented indicators for the fulfillment of the minimum national requirements for occupying the academic position "Associate Professor" at IPPG-BAS (described in Table 1 of the Regulations) are:

Group A (Ph.D. Thesis) – **50** points

Group B (scientific publications indexed in Web of Science and Scopus) – **110** points (required minimum 100 points)

Group C (total publication activity) – **260** points (required minimum 200 points)

Group D (citations) – **346** points (required minimum 100 points)

Group E (which summarizes project activity) – **70** points (required minimum is 70 points).

Groups B and C: The candidate presents **43** publications, of which **36** are full research papers and **7** are review articles. Six of the listed manuscripts (No. 35, 37, 38, 39, 40 и 41) are related to the Ph.D. Thesis so they should not be considered in the competition. **Twenty six** articles from the list are published in journals with an impact factor. Their distribution by quartiles (JCR or SJR) is as follows: **7** publications with **Q1**, **12** (**Q2**), **8** (**Q3**) and **1** (**Q4**). The candidate is listed as the first author in **22** of the papers (**11** of them participate in the competition). Dr. Katerova-Landzhova is a co-author of **5** book chapters that are indexed in WoS or Scopus and **10** scientific publications in peer-reviewed journals not indexed in WoS and Scopus. The total JCR IF of the listed publications is **35.569.**

Group D: According to the information provided by the candidate there have been found **463** citations (mainly by international authors). These are references to **32** (out of 42) of her published studies. The Scopus or WoS referenced manuscripts of the candidate are cited **188** times, and **176** of them are related to publications that participate in the competition.

Group E: The candidate includes detailed information on her track record, comprising project activities and participation in national and international scientific forums. Dr. Katerova-**Landzhova** was involved in **14** research projects funded mainly national sources like the Scientific Research Fund and the Ministry of Education and Science. She has acquired **4** scholarships (2 from JSPS, 1 from FWO and 1 from the TEMPUS program). Dr. Katerova-Landzova presented the results of her research in the form of **posters (20) and oral reports (2)** and the respective scientific forums are listed in the documents.

3. Published research papers participating in the completion for the academic position of "Associate Professor"

Dr. Katerova-Landzova participates in the competition with **21** publications (including 3 book chapters). The candidate is listed as the first or corresponding author in **12** of them suggesting professional maturity and ability to perform independent research in the chosen scientific field. The main contributions of Dr. Katerova-Landzhova's scientific activity are summarized in 8 pages, providing systematized information about the experimental work performed. She clearly describes her personal contribution to each of the published studies and

convincingly demonstrates a high level of competence in the subjects she works on. The submitted papers for the competition outline the well-defined research profile of Dr. Katerova-Landzova and her professional approach to the study of the physiological effects of UV radiation and the application of growth regulators to overcome the negative consequences of various abiotic stress factors in economically important crops. The total JCR IF of all publications for the competition is **22.225**. The JCR IF of the papers in which the candidate is listed as the first or corresponding author is **14.178**.

4. Evaluation of the scientific achievements

Dr. Katerova-Landzhova has worked on problems related to the study of physiological responses to stress induced by UV-B and UV-C light. In most of the experiments, the focus has been put on economically important monocot and dicot crops such as wheat, triticale, peas, etc. The range of different biochemical and physiological techniques for analyses that she has mastered correspond to a well-defined research profile in the field of stress physiology. I believe that the presented document "Author's Reference for Scientific Contributions" convincingly argues the suitable candidacy of Dr. Katerova-Landzhova for the competition for "Associate Professor" in "Plant Physiology" in the laboratory "Regulators of Plant Growth and Development" of IPPG-BAS.

Her research could be conditionally summarized in two main scientific topics: "**Ultraviolet Radiation in Important Crops and Possibilities to Overcome its Negative Effects by Applying Plant Growth Regulators**" and "**Physiological Effects of Other Abiotic Stresses in Important Crops and the Stress-Modulating Effect of Different Plant Growth Regulators**".

4.1. Ultraviolet Radiation in Important Crops and Possibilities to Overcome its Negative Effects by Applying Plant Growth Regulators

4.1.1. Physiological responses of different plant crops to UV-B and UV-C light.

This part of Dr. Katerova-Landzhova's research is a continuation of the topic of her Ph.D. dissertation. As a participant in several scientific projects, she has the opportunity to further develop her professional capacity and obtain interesting results related to the physiological reactions of monocotyledonous and dicotyledonous crops to UV light irradiation (B4-1, B4-2, B4-3, B4-4, B4-5, B4-6, G7-1, G7-2, G7-3, G7-4).

One of the highlights of her work on this topic, which deserves to be mentioned, is research on the effect of low-intensity UV-C radiation for an extended period of time (B4-6, G7-1). This scientific approach allows tracking the dynamic changes in the plant's defense systems under constant damaging radiation. Along with other publications on the subject, regarding observations on the effects of UV-B light, the valuable information obtained on the activation of various components of the stress response, has both fundamental and applied value, as it reveals the capacity of UV light as an agent that activates synthesis of secondary metabolites with potentially beneficial properties. Dr. Katerova-Landzhova summarizes this useful application in a book chapter discussing the potential of different types of light as an inducer for the accumulation of valuable metabolites in medicinal and other plant species (G8-1).

4.1.2. Possibilities to overcome the negative physiological effects of ultraviolet radiation (UV-B and UV-C) by exogenous application of growth regulators. (as reflected in publications B4-1, B4-3, B4-4, B4-5; G7-2, G7-3, G7-4).

Dr. Katerova-Landzhova has performed research that focuses on using exogenous growth regulators to alleviate UV damage. This types of experiments include tests with monocots (B4-1, B4-3; G7-2, G7-3) and dicots (B4-4, Б4-5; G7-4). The protective effects of humic acids, itaconic acid monomethyl ester (MEIC), exogenously applied polyamines and synthetic auxin analogues were tested in plants subjected to UV-B or UV-C stress. It was shown that the better physiological status of irradiated plants that were pre-treated with growth regulators such as MEIC, humic acids and spermine was largely due to the activated accumulation of non-enzymatic antioxidants (G7-2, G7-3 and B4- 3, B4-4).

Dr. Katerova-Landzhova and her colleagues found that the protective properties of the product “Biomin”, containing humic acids, was due to the accumulation of free amino acids and polyamines in the leaves of irradiated triticale plants (B4-1). In another study, they showed that synthetic auxin analogs can exert a protective effect on UV-B irradiated pea plants by enhancing enzymatic and non-enzymatic antioxidant defenses (G7-4).

4.2. Physiological Effects of Other Abiotic Stresses in Important Crops and the Stress-Modulating Effect of Different Plant Growth Regulators

Dr. Katerova-Landzhova submits 10 publications for participation in the competition related to this research topic, and she divides them into two subcategories.

4.2.1. Physiological effect of abiotic stressors such as drought, waterlogging and herbicide application (publications G7-5 to G7-11, G8-2)

The importance of the problem related to this part of her research work is presented convincingly, outlining the important aspects affecting crop yield and issues related to environmental protection. Research on economically important crops such as wheat (G7-5, G7-6, G7-8, G7-9) and triticale (G7-7, G7-10) and the impact of stress factors such as drought (G7-6 to G7-10) and waterlogging (G7-5, G7-7 to G7-10) on their productivity is presented in sufficient detail. Studies on the physiological effects observed as a result of the application of herbicides, alone (G7-11) or in combination with abiotic stress factors (G7-5 to G7-10) are also indicated. This is of great concern in modern agricultural practice, and it is related to the observed increasing resistance to conventional herbicides. This topic is discussed in another publication submitted for participation in the competition (G8-2). In it, Dr. Katerova- Landzhova summarizes the important role of glutathione for the effective detoxification of xenobiotics. The used experimental toolset and research approaches confirm the candidate's professional qualities as a competent specialist in the field of stress physiology. Some of the more important results presented in this category are directly related to strategic sectors such as intensive grain production under adverse climate conditions. In this regard, the results obtained within the framework of a project financially supported by the National Science Fund (KP-06-H36/3, 2020-2024), described in publications G7-5 to G7-10, deserve particular appreciation. The comprehensive study of the physiological response of wheat and triticale to the combined effect of standard doses of selective herbicide and drought or waterlogging has a very high practical value. The study offers valuable insights into how the two crops respond to treatments with these commonly used agrochemicals, and how their resistance to water deprivation or flooding could be affected by conventional herbicide application.

For participation in the competition, Dr. Katerova-Landzhova includes another study on the effect of herbicides on the activity of IAA-oxidase, an enzyme related to the metabolism of auxins (G7-11). She proposes a suitable modification of the method for its determination, which is an essential technical contribution to the experimental work.

4.2.2. Possibilities to overcome the negative physiological effects of abiotic stresses (drought and herbicides) by exogenous application of growth regulators (publications G7-12 and G8-3).

Dr. Katerova-Landzhova indicates in the document describing her scientific contributions the research done on the application of growth regulators as a method to alleviate the impact of abiotic stress. This is a continuation of her research interests in this field that are apparent also in the UV stress-related topic. To this category of research, she lists two papers for participation in the competition. One of these publications is a review (G8-3), and the other one presents a study of the modulating effect of 24-epibrassinolide on glyphosate-treated wheat (G7-12).

5. Recommendations

The well-arranged presentation of the materials for participation in the current competition is highly appreciated as this significantly facilitates their assessment.

Dr. Katerova-Landzhova has established herself as a competent researcher in the field of plant physiological response to various types of abiotic stress. She has consistently demonstrated her interests in discovering methods to overcome the negative effects of harmful environmental influences through the application of plant growth regulators and biologically active compounds. The accumulated knowledge and professional wisdom provide a sufficient basis for higer mentoring and teaching activity by which Dr. Katerova-Landzhova could attract new young colleagues to whom she can pass on her professional experience.

I am familiar with the (yet) unpublished results of her work on poly (A)-binding proteins carried out within the framework of postdoctoral specializations in Japan. This fundamental topic is extremely important, since proteins of this class are the main regulatory elements of RNA metabolism and are found in almost all eukaryotes. In addition, PABPs perform very important functions in the processes related to plant development and stress responses. I recommend the candidate to continue and further develop this extremely promising line of research, which would greatly contribute to the enrichment of the IPPG-BAS portfolio.

6. Conclusion

Dr. Katerova-Landzhova is very actively involved in the projects of the "Regulators of Plant Growth and Development" Laboratory. As a scientist with considerable experience gained in international research teams during her professional work assignemnts abroad, she is extremely active in the interpretation of experimental results. She is acknowledged by her colleagues as a skilled co-author who is very efficient in writing and editing of research papers.

Based on the thorough review of the materials submitted for the competition, the presented project activities, and scientific achievements, and taking into account the solid basis

for further development of the scientific topics on which she works, I address the respected members of the Scientific Jury and the Scientific Council of IPPG-BAS and **recommend awarding Dr. Zornitsa Katerova-Landzhova** from the laboratory "Regulators of Plant Growth and Development" of IPPG-BAS **the academic position "Associate Professor"** in **"Plant Physiology"**.

18.06.2024 Reviewer:

Sofia (Assoc. Prof. Irina I. Vaseva)