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REVIEW

of the materials submitted for participation in the competition for the academic position of "Associate Professor" at the Institute of Biodiversity and Ecosystem Studies (IBER), Bulgarian Academy of Sciences in the field of higher education: 4. "Natural Sciences, Mathematics and Informatics"; professional field: 4.3. "Biological Sciences"; Scientific specialty: "Genetics", announced in the State Gazette No. 110/31.12.2024 for the needs of the section "Environmental Mutagenesis" at the Department of "Ecosystem Studies"

by Prof. Dr. Veneta Mihova Kapchina-Toteva, Faculty of Biology of Sofia University, retired, appointed as a member of the scientific jury, according to Order No. 18/28.02.2025 of the Director of IBER.

I. Professional and career development of the candidate. For the "Associate Professor" competition, only documents from Dr. Petya Nikolaeva Parvanova, Assist. Prof. at the Institute of Biodiversity and Ecosystem Studies - BAS, were submitted. All documents for the competition were submitted according to the requirements set out in the Regulations for the terms and procedure for acquiring scientific degrees and occupying academic positions at the IBER and meet the criteria for occupying the academic position of "Associate Professor". Petya Parvanova graduated with a bachelor's degree, majoring in Ecology in 2003 at the Southwestern University "Neofit Rilski" - Blagoevgrad, and in 2005 with a master's degree in Ecology at the Faculty of Biology of the Sofia University "St.Kl. Ohridski". In the period 2007-2011, the candidate was a doctoral student at the Central Laboratory of General Ecology/IBER, where she defended her doctoral thesis on the topic "Influence of tropospheric ozone on the physiological activity and some biochemical indicators of seedlings of sensitive and tolerant tree species". Her scientific career began in November 2005, successively holding the following positions: biologist (2005-2006), full-time doctoral student (2007–2010), ecologist (2010), assistant professor (2010–2011) and assistant professor (2011 – until now), in the section “Environmental Mutagenesis”, department “Ecosystem Research, Ecological Risk and Conservation Biology” at IBER-BAS. Extremely important for the establishment and as a specialist are the scientific research on the reaction of plants at the organismal and cellular level to the action of ozone; the mechanisms/systems involved in overcoming induced stress and genotypic resistance; active expert activity (Head of the Section (acting) “Environmental Mutagenesis”; representative of young scientists in the National Council of IBER, BAS; Secretary of the Section "Biology", SUB; Secretary of the Organizing Committee of the

"Seminar on Ecology"; reviewing scientific articles). Distinctive features of Dr. Parvanova are her high work capacity, responsibility for the obligations undertaken, communication skills, and teamwork skills. These qualities define her as a desirable partner in interdisciplinary research and to date she has participated in 25 scientific projects with national and international funding from: National Science Foundation, EDB, 6th Framework Program, FP7, COST Action FP0903, European Program LIFE+ and others. Dr. Parvanova's activity in the development and implementation of projects that have contributed significantly both to her development and financially to the improvement of the scientific research base is obvious. She has participated in 54 national and international forums, at which the results of scientific research have been presented in 11 poster presentations, 2 plenary and 41 reports.

II. Teaching experience. Role of the candidate in the training of young scientists. Dr. Petya Nikolaeva Parvanova has many years of experience as a part-time lecturer at the Faculty of Biology of Sofia University and the University of Forestry: a total of 376 hours of lectures in Ecology and Environmental Protection and Biochemistry. She has one successfully defended masrer student in 2021 at the Department of Genetics of the Faculty of Biology of Sofia University; she is a scientific advisor to a full-time doctoral student at the IBER and Co-author of 3 chapters of a textbook for students of the Department of Ecology, Faculty of Biology.

III. Scientific research and publication activity, citations. Fulfillment of the requirements for holding the academic position of "associate professor", personal contribution of the candidate. In the competition for "associate professor" Dr. Petya Parvanova participated with a total output of 48 works, most of which were published in renowned journals with IF/SJR such as: Toxicology; Environ Sci Process Impacts; Water, Air, and Soil Pollution; Comptes Rendus de L'Academie Bulgare des Sciences; Biorisk. Scientific works related to the doctoral dissertation (1, 2 and 3) are not subject to review. The publications submitted in the competition for "associate professor" and subject to review are 23 with a total IF - 11.449 and SJR - 2.163, of which:

- Group A - 50 points (required 50 points): Dissertation on the topic "Influence of tropospheric ozone on the physiological activity and some biochemical indicators of seedlings of sensitive and tolerant tree species", for obtaining the ONS "doctor" in Ecology and Ecosystem Protection.

- By indicator 4 in group B - 110 points (required 100 points): A total of 8 publications equivalent to a habilitation thesis are presented (1-Q2, 4-Q3, 2-Q2 with SJR and 1-Q4 with SJR).

- By indicators 7 and 8 in group D - 225 points (required 220 points): 13 publications are presented in publications, referenced and indexed in world-renowned databases with IF and/or

SJR (3- Q1, 1-Q2, 3-Q3, and 5 - Q2 with SJR and 1-Q4), as well as chapters from 2 books. The personal participation of Dr. Petya Parvanova in the mentioned 23 scientific papers is indisputably illustrated by the fact that in 12 of them (52%) she is the first, second or last author.
- By indicator in group D – 52 citations (h index: 3 by Scopus and Web of Science) of scientific works have been registered - 104 points (required 60 points) and another 28 in dissertations, books and other articles. The citations are in renowned journals with IF such as: *Journal of Environmental Science and Health; Journal of Environmental Protection and Ecology; Journal of Hazardous Materials; Environmental Science and Pollution Research; Journal of Soil Science and Plant Nutrition; Plants; BioMed Research International; Frontiers in Plant Science; Ecotoxicology and Environmental Safety; Clean - Soil, Air, Water; Environmental Geochemistry and Health* and others.

The total number of points from all indicators is 489, with which Dr. Petya Parvanova exceeds the minimum requirements (400 points) for holding the academic position of "associate professor" according to the Regulations of IBER-BAS. My conclusion on this part of the analysis of the scientific and pedagogical activity of the Assist. Prof. Petya Parvanova is that the procedure has been followed and the documentation has been prepared in accordance with the requirements of the Law on the State of the Republic of Bulgaria and the regulations for its application for occupying the academic position of "associate professor". The scientific production of the candidate submitted for the competition does not contain works that go beyond the scope of the main nomenclature specialty. She participates in the competition with scientific works that fully correspond to the professional direction of the discipline in terms of volume and quality.

IV. Contributions. Assist. Prof. Dr. Petya Parvanova has a clearly expressed profile of a researcher who fully corresponds to the wording of the announced competition. The main areas of research in "Environmental Mutagenesis" are:

1. Prevention of induced mutagenesis (antimutagenesis) through exogenous application of natural products;

2. Assessment of the mutagenic and commutative properties of xenobiotics from the environment using a complex of in vivo tests and criteria with different permissive capabilities: microbiological, biochemical and molecular;

3. Analysis of the mechanisms of genotypic and induced resistance (adaptive response – AO) and study of the scale of the adaptive response from genome resistance. Four test systems were used – unicellular green algae of the genera *Chlamydomonas* and *Chlorella*, yeast – Saccharomyces cerevisiae, higher plants – *Pisum sativum L., Phaseolus vulgaris L., Solanum*

tuberosum L., peach aphid - Myzus persicae. The main objects of the candidate's research are *Chlamydomonas reinhardtii* [B4.1; B4.2; B4.3; B4.4; B4.6; B4.7; B4.8; Г7.11; Г7.12; Г8.1; Г8.2] and higher plants [B4.5; Г7.4; Г7.11; Г7.13; Г8.1], and actively participates in the research conducted with the other two objects - Saccharomyces cerevisiae [B4.8; Г7.1; Г7.6; Г7.8; Г7.9; Г7.10; Г7.11; Г7.12] and Myzus persicae [B4.8; Г8.1].

- The wide distribution of unicellular green algae in nature - lakes, swamps, puddles, soils, saltwater pools; the short life cycle; the haploid set of chromosomes, which allows recessive mutations to manifest themselves in the first generation; the relatively easy method of laboratory cultivation with a rich collection of highly radio- and chemo-resistant and defective in various types of repair strains, the eukaryotic structure typical of the plant cell; a photosynthetic organism with a well-formed chloroplast typical of a plant cell, makes unicellular green algae of the genera *Chlamydomonas* and *Chlorella* a convenient model in studies in the field of genotoxicology, mutagenesis and antimutagenesis, screening of various anthropogenic pollutants, using a wide range of biochemical and molecular markers for induced oxidative stress and studying the mechanisms of genotypic resistance. [B4.1; B4.2; B4.3; B4.4; B4.6; B4.7; B4.8; Г7.11; Г7.12; Г8.1; Г8.2]. *Pisum sativum L., Phaseolus vulgaris L. and Solanum tuberosum L.* are suitable objects for elucidating the mechanisms and systems involved in the formation of the stress response and genotypic resistance in higher plants [B4.5; Г7.4; Г7.11; Г7.13; Г8.1]. A complex of test systems with different permissive capabilities was used - Chlamydomonas reinhardtii [B4.3; B4.6; B4.7; B4.8; Г7.11; Г8.1]; higher plants [B4.5; Г7.4; Г7.11; Г7.13; Г8.1]; *Saccharomyces cerevisiae* [B4.8; Г7.11] and *Myzus persicae* [B4.8; Г8.1], and a set of chemical, microbiological, biochemical and molecular markers.

- The total leaf extract of narcissus and oregano essential oil have a well-expressed genotoxic and DNA damaging capacity in the model organism *Chlamydomonas reinhardtii,* but do not possess mutagenic potential [B4.3; B4.6; B4.7; Г8.1]. The information obtained is a contribution to "green technologies".

- The differences in the biological activity of the two fractions of the methanol extract of oregano are probably due to the main substance - carvacrol in the non-polar fraction, which is characterized by a strongly pronounced genotoxic and DNA damaging effect in *Chlamydomonas reinhardtii,* unlike the polar fraction [B4.6]. The results are of interest for future research for the purposes of "green technologies".

- It has been proven that increased levels of lipid peroxidation and intracellular peroxides can be used as cheap and reliable early markers for assessing the extent of induced oxidative stress

in plant test systems [B4.5; D7.4; D7.13; D8.1]. The information obtained can be used for the purposes of genotoxicology.

- For the purposes of genotoxicology, 2 complexes of test systems and criteria for assessing the damaging potential of xenobiotics present in the environment have been developed [B4.8; Г7.11]:

1. It has been established that the broad-spectrum pesticide chlorpyrifos has genotoxic, mutagenic, phytotoxic, aphicidal, DNA-damaging, recombinogenic and clastogenic effects.
2. The established genotypic differences in the sensitivity of *Chlamydomonas reinhardtii, Saccharomyces cerevisiae* and *Phaseolus vulgaris L.* allow unicellular green algae to be indicated as a sensitive test system for detecting low concentrations of PbCl2.
3. New information has been obtained that PbCl2 damages photosynthetic pigments and DNA indirectly through induced oxidative stress.

Direction 3: Mechanisms of genotypic resistance.

- Original information has been obtained in different test systems – *Chlamydomonas reinhardtii, Saccharomyces cerevisiae, Phaseolus vulgaris L., Pisum sativum L., Myzus persicae* on the role of the developmental phase, the mitotic cycle and the DNA repair capacity in the formation of genotypic resistance [B4.4; B4.5; Г7.1; Г7.4; Г7.6; Г7.9; Г7.10; Г7.12; Г7.13].

1. Using mutant and engineered unicellular organisms and a complex of microbiological, biochemical and molecular methods, new data have been obtained on the role of the physiological state, the phases of the mitotic cycle and the reparative potential of cells in the development of the stress response and genotypic resistance to chemical inducers of oxidative stress of different nature (extract of *Clinopodium vulgare L.*, zeocin, menadione, bee venom). The results are a contribution to the hypothesis of the mechanisms involved in the formation of genotypic resistance [B4.4; Г.1 Г7.6; Г7.9; Г7.10].
2. It has been established that the strength of the induced oxidative stress strongly depends on the genotype. The role of Pro and HSP70 is particularly emphasized. As a very sensitive marker, Pro can be recommended for distinguishing the stress response even in closely related genotypes and allows differentiation of the most sensitive ones. Overproduction of HSP70 is an early signal of oxidative stress and plant adaptation. The results are a contribution to genotoxicology with benefits for agriculture [B4.5; Г7.4; Г7.12; Г7.13].

Direction 4. Assessment of the effect of anthropogenic pollutants and environmental factors using a higher plant test system. Assessment of the effect of anthropogenic pollutants and environmental factors using a higher plant test system [Г7.2; Г7.3; Г7.5; Г7.7], are related

to ecotoxicology and agriculture. By applying chemical, morphometric, physiological and biochemical methods in different test systems, valuable information has been obtained about the stress response of test objects exposed to various anthropogenic pollutants [Г7.2; Г7.3; Г7.5] and environmental factors [Г7.7].

1.1. In Fraxinus excelsior L. seedlings in urban and mountainous environments, by applying a set of physiological and biochemical parameters, it has been established that the increase in antioxidant enzyme activity can be used as an indicator for assessing the effect of the atmospheric pollutant. The obtained new and original information is a contribution to ecotoxicology.

1.2. In hydroponically cultivated corn plants, the effect of cadmium (CdCl2) and paraquat (PQ) was evaluated. In the future, the results obtained would be of interest for the purposes of ecotoxicology and phytoremediation.

1.3. In plants treated with wastewater from Radomir Metal Industries, Bulgaria, a recommendation was made that wastewater from the metallurgical plant should not be used for irrigation of arable land. The applied model can be used in ecotoxicological studies for the purposes of agroecology.

2. In four varieties of *Lactuca sativa* L. Through a set of physiological parameters, it was established that green leafy salads exhibit the best adaptability to low temperature and shading, which can be used in practice to extend the period of vegetative growth. [Г7.7].

V. Personal impressions. I know Assist. Prof. Dr. Petya Parvanova from a doctoral student and I must note her development as a qualified, erudite and expeditious scientist, developing a modern, relevant and with serious potential for application in practice topic.

CONCLUSION Based on the analysis of active scientific research activity, expert and pedagogical activity, volume of scientific production, interpretation of scientific data and contributions, their reflection in the international scientific literature, participation in scientific research projects, presentation of results at international and national scientific forums, I firmly believe that Dr. Petya Parvanova fully meets the requirements of the ZRASRB, PPZRASRB and the Regulations and recommended criteria for holding academic positions at IBER, BAS. All this gives me reason to evaluate **POSITIVELY** her overall activity. I would like to propose to the esteemed Scientific Jury to vote positively, and the Scientific Council of IBER to elect Assist. Prof. Dr. Petya Parvanova as "Associate Professor" in the professional field 4.3. Biological Sciences; Scientific specialty: Genetics.

Date: 22.04.2025. Sofia REVIEWER:

(Prof. Dr. Veneta Kapchina-Toteva)