#### **EVALUATION REPORT**

by Prof. Dr. Katya Marinova Georgieva, Institute of Plant Physiology and Genetics (IPPG) -Bulgarian Academy of Sciences, appointed as a member of the scientific jury by order of the Director of the IPPG Nº RD-01-16/22.04.2025.

on a competition for the academic position "Associate Professor" in the professional field 4.3 Biological Sciences, scientific specialty "Genetics", announced in the SG Nº 16/25.02.2025 for the Laboratory "Regulators of Plant Growth and Development"

Assistant Professor Dr. Maria Ivanova Petkova is the only candidate for the announced competition. The presented documents for participation in the procedure are prepared according to the requirements of the Law for Development of the Academic Staff in the Republic of Bulgaria and are in line with the Regulations for acquiring scientific degrees and holding academic positions at IPPG-BAS.

## General information about the candidate's career and thematic development

Maria Petkova graduated from the Faculty of Biology of Sofia University "St. Kliment Ohridski" in 2001 as a Master in Biology and Chemistry, with a specialization in Medicinal Plants. During the period 2003-2011 she worked at the Institute of Genetics as a research associate III degree, and from 2011 to the present as an Assistant Professor at the Institute of Plant Physiology and Genetics. In 2013 she successfully defended her Ph.D. thesis on the topic "Biotechnological approaches for propagation and obtaining biomass from hairy roots in *Arnica montana* L." and obtained a Ph.D. Degree " in the scientific specialty "Genetics".

Dr. Maria Petkova has a total of 52 scientific publications (total impact factor of 59.23), of which she is the first or corresponding author in 25 publications. In the competition for the academic position "Associate Professor", she presents 21 scientific publications. Their distribution by quartiles is as follows: 7 publications have Q1, 5 are with Q2, 2 with Q3, 1 with Q4, 4 publications with SIR without impact factor and 2 publications in peer-reviewed journals not indexed in WoS and Scopus. The total JCR IF of the publications for the competition is 36.51, and in 10 of them she is first and/or corresponding author. According to the submitted reference, the total number of citations of Dr. Petkova's publications is 425, of which 252 in publications indexed in Scopus or Web of Science, which proves the significance of the achieved scientific results. The number of participations of the candidate in scientific forums is impressive – 42 participations in 28 scientific forums. Maria Petkova has presented data on participation in 15 scientific projects, 10 of which were funded by the Scientific Research Fund, 2 by the Ministry of Education and Science, one by the Ministry of Environment and Water and 2 were in bilateral cooperation with Slovakia and Egypt. She was a leader of a youth project and of an ongoing project at the Scientific Research Fund. The research of Dr. Maria Petkova is extremely targeted, it is a continuation of the topic of her dissertation work and is in the field of biotechnology of medicinal and aromatic plants. Directly related to the topic she is developing is her 3-month specialization in Finland.

# Evaluation of the submitted references for compliance with the requirements of the Law on the development of academic staff in the Republic of Bulgaria and the specific requirements for the position of "Associate Professor" at IPPG-BAS

Dr. Maria Petkova participates in the competition with a total amount of 928 points, which significantly exceeds the required minimum of 540 points. The presented indicators for the fulfillment of the minimum national requirements for occupying the academic position "Associate Professor" at IPPG-BAS are:

## Group A (Ph.D. Thesis) - 50 points

The total number of points according to **group B** indicators is **125** points (required minimum 100 points) – 6 publications are included (Q1 – 3, Q2 – 2, with SJR without IF – 1).

**Group C** includes 15 publications (Q1 – 4, Q2 – 3, Q3 – 2, Q4 – 1, with SJR without IF –3 and 2 publications not indexed in WoS and Scopus) with a total number of points **232** (required minimum 220 points). The total number of points from publications in which M. Petkova is the first or corresponding author is 110.

**Group D** (citations) – **348** points (required minimum 100 points). A reference is provided for 174 citations in publications indexed in Scopus or Web of Science for the last 5 years.

**Group E** – **173** points. The certificate presented by the candidate shows that she has participated in the development of 8 national scientific projects, one of which she is a leader and one international (110 points). For attracted funds under project KP-06-N76/5, of which Dr. Petkova is a leader – 63 points.

The presented scientific production and the achieved scientometric data are attestation of the good quality of the presented scientific production.

## Analysis of the main directions in the candidate's research work

The research investigations of Assistant Professor Dr. Maria Petkova are focused on two thematic areas: 1) Development and optimization of highly efficient *in vitro* protocols for propagation, biomass production and synthesis of biologically active substances from medicinal plants of the Asteraceae family; 2) Modulation of the synthesis of biologically active substances through gene transfer or application of elicitors of abiotic and biotic origin in medicinal plants of the Asteraceae family. The contributions of Dr. Petkova's scientific research activities have not only theoretical significance, but also a certain practical focus.

The results of the research on the first thematic area have been published in 11 scientific articles (*publications B4-4, B4-5, B4-6, G7-3, G7-6, G7-9, G7-10, G7-12, G7-13, G7-14, G7-15*). Effective protocols for accelerated micropropagation of the endangered plant species, mountain arnica and yellow smil, as well as economically important species such as stevia, echinacea, chicory, have been developed. It has been shown that *Arnica montana* plants obtained *in vitro* and acclimatized in mountain conditions synthesize a higher amount of sesquiterpene lactones than conventionally propagated plants (*publications B4-4, G7-9*). A protocol for micropropagation of yellow smil has been developed, which allows the cultivation of genetically uniform plant material (*publication G7-6*). Of essential importance is the optimized method for *in vitro* propagation of stevia, which guarantees the production

of 90% *ex vitro* acclimatized viable plants, thanks to which the low germination of seeds has been overcome (*publication B4-5*). It has been established that *in vitro* propagated Echinacea plants are distinguished by a higher yield of inflorescences and have a high antioxidant capacity compared to those propagated in a conventional way from seeds (*publication B4-6*). The study of the influence of the phenylurea cytokinin 4PU-30 on *the in vitro* propagation of chicory is of original nature (*publication G7-3*).

Part of the studies in this research area is aimed at optimizing the conditions for increasing the biosynthesis of secondary metabolites in *in vitro* cultivated plants. Particular attention is paid to the influence of the type of nutrient medium and cultivation systems (*publications G7-10, G7-12*), the propagation method (*publications G7-9, G7-13, B4-6, G7-3*), the age and phase of development (*publications 7-9, B4-5, G7-13*) and the origin of the seeds (*publications G7-9, G7-10, G7-10, G7-13, B4-5*) on the synthesis of biologically active substances. New information has been obtained on the synthesis of secondary metabolites and the antioxidant activity of extracts from *in vitro* cultivated, *ex vitro* adapted and acclimatized to external conditions plants.

A significant part of Maria Petkova's research is devoted to the second thematic area – modulation of the synthesis of biologically active substances through various approaches (*publications B4-1, B4-2, B4-3, G7-1, G7-2, G7-4, G7-5, G7-7, G7-8, G7-11*). For the first time, the influence of different carbohydrate sources on the growth, development and metabolic profile of genetically transformed roots (hairy roots) of *A. montana*, obtained by genetic transformation with *Agrobacterium rhizogenes* has been studied (*publication G7-11*). Of original nature is the study of the influence of the biotic elicitor yeast extract, as well as the abiotic elicitor salicylic acid on micropropagation, accumulation of secondary metabolites and antioxidants in *A. montana* (*publications B4-1, G7-5, G7-2*). For the first time, the stability of the expression of nine candidate reference genes after application of the elicitors methyl jasmonate, yeast extract and salicylic acid has been assessed in *A. montana*, which is essential for studies on the molecular processes regulating the biosynthesis of secondary metabolites in medicinal plants (*publication B4-2*). A biotechnological method has been developed for the production of multiple stevia plants *in vitro* by direct organogenesis using nanofibers as well as nanofibers (*publications B4-3, G7-4, G7-4, G7-1, G7-8*).

In the presented documents, Maria Petkova clearly describes her own contribution to the publications. The description of Dr. Petkova's future research plans show that she has a clear vision of how to expand and deepen her research.

#### Relevance of the scientific topic and its significance for science and society

The scientific interests and research of Dr. Maria Petkova are focused on an extremely relevant scientific field and have important scientific and applied significance. Effective protocols have been developed for micropropagation of economically important, rare and endangered plant species with valuable pharmacological properties and application in medicine, the food and cosmetic industries. The work of M. Petrova is of undeniable public importance, as it contributes to the preservation and spread of these plant species. The conditions for increasing the biosynthesis of secondary metabolites in *in vitro* cultivated

plants have been optimized, which have been successfully acclimatized to *ex vitro* conditions and it has been shown that they are morphologically similar and have high antioxidant capacity. Research on the modulation of the synthesis of biologically active substances expands and deepens the fundamental knowledge of the physiological and biochemical changes in the *in vitro* cultivation of mountain arnica and stevia by applying elicitors of abiotic and biotic origin.

## Organizational and educational activities

Dr. Maria Petkova is the supervisor of two graduate students (Bachelor and Master) from Sofia University "St. Kliment Ohridski". She has conducted practical training on *in vitro* cultivation of medicinal plants for postdoctoral student Magdalena Sozoniuk from the University of Natural Sciences, Lublin, Poland under the Erasmus scholarship program. She has been a leader of two projects at the Scientific Research Fund (one youth and one ongoing) and is a participant in a number of scientific research projects.

# Conclusion

The presented materials convincingly show that Dr. Maria Petkova is a well-established and productive researcher in the field of biotechnology of medicinal and aromatic plants. The scientific works contain significant fundamental and applied contributions that have received international recognition. The overall scientific activity of Dr. Petkova is up-to-date and very well presented. The assessment of Maria Petkova's scientific and research activity shows that she meets all the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria, the Regulations for its implementation, and the internal rules of IPPG-BAS for occupation of the academic position "Associated Professor".

All this gives me reason to support her candidacy and to confidently recommend to the esteemed members of the Scientific Jury and the members of the Research Council of the IFRG-BAS to award Dr. Maria Ivanova Petkova the academic position of "Associate Professor" in "Genetics".

10.06.2025 Sofia

/Prof. Dr. Katya Georgieva/