ASSESSMENT REPORT

from Prof. Dr. Valya Nikolova Vasileva – Institute of Plant Physiology and Genetics at the Bulgarian Academy of Sciences (BAS)
regarding the competition for the academic position of "Associate Professor" in professional field 4.3 Biological Sciences, scientific specialty "Genetics"

1. General information about the competition and submitted documents

The competition for the academic position of Associate Professor in the scientific specialty "Genetics" was announced in the State Gazette, issue 16, dated 25.02.2025, for the needs of the Laboratory "Regulators of Plant Growth and Development" at the Institute of Plant Physiology and Genetics (IPPG) – BAS. The sole applicant for the announced position is Dr. Maria Ivanova Petkova, who is currently a researcher in the same laboratory. The submitted application documents comply with the requirements of the *Law on the Development of Academic Staff in the Republic of Bulgaria*, *the Regulations for its Implementation (ZRASRB)*, and the *Regulations on the Conditions and Procedures for Acquiring Scientific Degrees and Holding Academic Positions at IPPG-BAS*.

2. General data on the professional and thematic development of the Candidate

Dr. Maria Petkova earned her Master degree in Biology and Chemistry with a specialisation in Medicinal Plants in 2001 from the Faculty of Biology at Sofia University "St. Kliment Ohridski". In 2003, she began her professional career at the Institute of Genetics "Acad. Doncho Kostov"–BAS, where her primary research focus was the development of innovative *in vitro* cultivation methods for medicinal and aromatic plants aimed at increasing their productivity. Between 2011–2013, she pursued doctoral studies through independent preparation at IPPG-BAS. In January 2014, she successfully defended her dissertation titled "Biotechnological approaches for reproduction and biomass production from 'hairy roots' in *Arnica montana* L.", earning the educational and scientific degree "Doctor" in the scientific specialty Genetics. Since 2011, Dr. Petkova has held the position of Assistant Professor in the Laboratory "Regulators of Plant Growth and Development" at IPPG, where she continues her research in the field of biotechnology of medicinal and aromatic plants. Her work integrates biotechnological and genetic approaches to produce biomass from economically important, rare and endangered plant species. She also focuses on the development of highly productive clones and *in vitro* systems for the controlled cultivation of plant material with specific characteristics.

3. Analysis of the scientific output and assessment of compliance with the regulatory requirements of the Candidate indicators

3.1. Review of scientific output

Dr. Maria Petkova has presented a strong and consistent scientific output with a total of 52 publications - 48 original research articles and 4 review papers, accumulating a total impact factor of 59.230.
For the current competition for the academic position of Associate Professor, she has submitted 21 peer-reviewed publications in international journals indexed in global databases, with a total impact factor of 36.511. The articles are published in reputable journals such as *BMC Plant Biology*, *Plants*, *International Journal of Molecular Sciences*, *Agronomy*, *Acta Physiologiae Plantarum*, etc. According to the submitted documents, the H-index (Scopus) of Dr. Petkova is currently 9, with an update to 11 as of June 10, 2025. In terms of publication quality (based on Scopus quartile classification), the submitted articles are distributed as follows: Q1 – 7 publications, Q2 – 5, Q3 – 4, Q4 – 3 and 2 publications in journals not classified by quartile. Dr. Petkova is the first and/or corresponding author in 10 of these publications.

3.2. Assessment of compliance with indicator groups

This section evaluates research metrics of Dr. Petkova against the regulatory requirements of IFRG and ZRASRB for the academic position of Associate Professor, according to indicator groups A to E.
Group A – successfully defended PhD dissertation, awarding 50 points (*required minimum – 50 points*).

Group B – six research publications with a cumulative impact factor of 14.834 (3 in Q1, 2 in Q2 and 1 in Q3), awarding 125 points (*required minimum - 100 points*). Dr. Petkova is the first or corresponding author in two of these, contributing 35 points (total IF: 4.0).
Group G – fifteen publications with a total impact factor of 21.677, awarding 232 points (*required minimum - 220 points*). These include 4 publications in Q1, 3 in Q2, 3 in Q3, 3 in Q4 and 2 in journals with SJR but without IF. Dr. Petkova is the first or corresponding author in 8 of these, earning 110 points, thus meeting the specific IFRG requirements for this indicator group.
Group D – a total of 252 citations (excluding self-citations) from 37 publications, awarding 348 points (*required minimum - 100 points*). A verified list of 174 citations from the last five years in WoS- or Scopus-indexed publications has been submitted.
Group E – participation in 15 projects with national and international funding: 10 funded by the Bulgarian National Science Fund (BNSF), including 3 targeting young researchers; 1 under bilateral international cooperation through BAS (EBR); 1 funded by the Ministry of Environment and Water (MOSW); 2 under the Operational Programme "Human Resources Development" and the Ministry of Education and Science (MES); and 1 international project. Points awarded: 90 (for participation in seven funded national and one international project), 20 (as project leader of an BNSF-funded project) and 63 (for attracted funding, indicator E-18), resulting in a total of 173 points (*required minimum - 70 points*).
Therefore, Dr. Maria Petkova meets and exceeds the requirements for the academic position of Associate Professor based on the indicators from groups B, G, D and E with a current total of 928 points across all indicator groups (*required minimum - 540 points*).

4. Analysis of the research directions and achievements of the Candidate

The research of Dr. Maria Petkova is centered on the biotechnology of medicinal plants from the Asteraceae family. She successfully integrates modern biotechnological and genetic methods, and maintains active collaborations with Bulgarian and international researchers. Her research profile is clearly defined and fully aligned with the requirements of the competition, encompassing two main directions.
The first research direction focuses to the development and optimisation of high-efficiency *in vitro* protocols for propagation, biomass production and stimulation of the synthesis of biologically active compounds (BACs) in Asteraceae species (B4-4, B4-5, B4-6, G7-3, G7-6, G7-9, G7-10, G7-12, G7-13, G7-14, G7-15). In this area, Dr. Petkova has made substantial contributions by establishing micropropagation and cultivation protocols for valuable species with high biomedical value, such as *Arnica montana*, *Stevia rebaudiana*, *Helichrysum arenarium*, *Echinacea purpurea* and *Cichorium intybus*. A major achievement includes the development of specific nutrient media and cultivation conditions that enhance the accumulation of valuable metabolites, including sesquiterpene lactones (STLs) and antioxidants. The results have clear practical application for the conservation and sustainable use of rare and endangered plant species. Furthermore, the increased productivity of plant biomass and improved adaptation to mountainous conditions show the potential for future industrial use.
The second research direction addresses the modulation of BAC synthesis through genetic transformation and the application of elicitors of abiotic and biotic origin (B4-1, B4-2, B4-3, G7-1, G7-2, G7-4, G7-5, G7-7, G7-8, G7-11). Noteworthy are her studies on transformed (hairy) roots as an alternative platform for the production of valuable metabolites with industrial potential. Dr. Petkova has explored the impact of different carbohydrate sources on the growth and development of hairy roots and has investigated the feasibility of their large-scale cultivation in bioreactors. Of particular interest is her research on the application of yeast extract and salicylic acid to boost antioxidant activity and the accumulation of specific secondary metabolites. Her innovative approaches include the use of nanofibers and nanofibrils to stimulate regeneration and increase the content of sweet diterpene glycosides in Stevia. Additionally, her investigations into the effects of creatine and creatine-lysinate on the growth and antioxidant status of *S. rebaudiana* and *Leontopodium alpinum* expand the understanding of novel biotechnological interventions. An important aspect of her work is the detailed analysis of the stability of reference gene expression following elicitor treatments, providing a valuable foundation for future molecular studies on the regulation of secondary metabolite biosynthesis.

Therefore, the work of Dr. Petkova is interdisciplinary, effectively bridging fundamental scientific knowledge with practical applications. This approach is particularly valuable in the current context of growing interest in the sustainable use of plant resources and the development of innovative products for the pharmaceutical and food industries.

According to the information provided, Dr. Petkova has made a substantial **personal contribution** at every stage of the research process - from the conception and planning of experiments to the analysis and interpretation of results. She has developed and optimised original protocols for the micropropagation of economically important and endangered plant species from the Asteraceae family. Notably, she introduced an innovative method for *A. montana* using RITA®-type temporary immersion systems, achieving over 18 plants per explant. Dr. Petkova has demonstrated expertise in the study of secondary metabolites, determining how various factors (propagation method, plant age, cultivation conditions) influence the synthesis of BACs. In the area of genetic transformation, she has developed and studied hairy root cultures of *A. montana*, analysing the effects of different carbohydrate sources on their productivity. Her leadership in FNI projects, long with her frequent role as first or corresponding author in key publications (e.g., B4-4, B4-5, B4-6, B4-1, B4-2, B4-3) confirms her prominent role in the research conducted. Part of the results has been achieved with financial support from national and international projects, in which Dr. Petkova participates as a project leader or participant, contributing to advancing research infrastructure and training young specialists in the field.

In summary, the research directions and achievements of Dr. Petkova are well-founded and original with strong potential for practical application.

5. Significance and relevance of the research topic and development opportunities

Research of Dr. Petkova is fully aligned with the priority areas of the European Union and Bulgaria, addressing major challenges in biotechnological production of plant biomass, conservation of endangered species and the sustainable use of natural resources. The planned innovative strategies to optimise the biosynthesis of target secondary metabolites using a range of growth regulators and elicitors, reflect a modern and forward-thinking approach to overcoming current production limitations. Particularly noteworthy is the proposed molecular-genetic analysis of *A. montana*, including the analysis of changes in the expression of genes *FDS*, *GAO* and *GAS* following elicitor treatment. This innovative methodology will provide a solid foundation for the development of advanced metabolic engineering strategies with strong potential for industrial application. The integration of bioreactor systems to achieve industrially relevant yields, combined with a focus on protected species from the Bulgarian flora, outlines direct applications in medicine, the pharmaceutical industry and cosmetics. The comprehensive scope of the research program successfully combines fundamental scientific inquiry with practical implementation, which positions Dr. Petkova as a leading researcher in the field of plant biotechnologies.

6. Organisational and training activity

Dr. Maria Petkova has contributed to the training and mentorship of young researchers in the field of biotechnology of medicinal plants. She is currently supervising two students (a bachelor and a master student) from Sofia University “St. Kliment Ohridski”, and has provided practical training in *in vitro* cultivation of medicinal plants to postdoctoral researcher Magdalena Sozoniuk from the University of Life Sciences in Lublin, Poland, under the Erasmus program in 2023.

She also possesses valuable organisational experience, gained through her leadership and participation in numerous national and international research projects funded by BNSF, bilateral agreements, operational programs of MES, MOSW and others. Her engagement in this area is further demonstrated by her participation in 42 international and national scientific forums, where she has presented her results through posters and oral presentations.

Her three-month specialisation at the Finnish National Research Institute (VTT, Valtion Teknillinen Tutkimuskeskus) in Espoo, Finland, along with her certificates of training activity and her experience as a reviewer for prestigious scientific journals, further emphasise her contribution to the development of new specialists and the international visibility of scientific research.

7. Critical remarks and recommendations

I have no critical remarks regarding the research activity of Dr. Petkova. However, I recommend that she broaden the scope of her research by incorporating integrated "omics" approaches (genomics, proteomics, metabolomics). This would build on her current studies and contribute to a deeper understanding of the molecular mechanisms underlying the biosynthesis and regulation of the investigated metabolites, as well as the mechanisms of plant adaptation to various stress factors. Additionally, deepening her research to include several major medicinal and/or aromatic plant species from the Asteraceae family with proven market potential would increase the practical applicability and the scientific visibility of her results. I fully support the intention of Dr. Petkova, as stated in the submitted materials, to develop more systematic training activity, including the supervision of doctoral students. I believe this will facilitate the transfer of her extensive experience and ensure the development of specialised personnel in the field of biotechnologies of medicinal plants.

CONCLUSION

Based on the submitted materials, I am confident that Dr. Maria Ivanova Petkova fully meets the regulatory requirements for holding the academic position of "Associate Professor" at IPPG-BAS. She has substantial experience in research focused on the development of methods for the *in vitro* cultivation of medicinal and aromatic plants to enhance their productivity, as well as their potential biotechnological applications. Her scientific interests and research outcomes align closely with the research topics pursued in the Laboratory "Regulators of Plant Growth and Development" at IPPG-BAS, and fully correspond to the scientific and strategic priorities of the Institute. I believe that Dr. Petkova possesses the necessary expertise and dedication not only to consolidate but also to further develop research activities in the field of biotechnology. She is also well prepared to actively participate in the training and supervision of doctoral students and young researchers.

For these reasons, I strongly recommend to the esteemed Scientific Jury to propose to the Scientific Council of IPPG-BAS the election of Dr. Maria Ivanova Petkova to the academic position of "Associate Professor" in the professional field 4.3. Biological Sciences, scientific specialty "Genetics".

10.06.2025

Prepared by:

(Prof. Dr. Valya Vassileva)