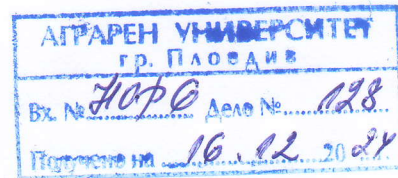


REVIEW



Regarding: the competition for the academic position of "Associate Professor" in the higher education field: 6. Agricultural Sciences and Veterinary Medicine; professional area: 6.2 Plant Protection; scientific specialty: "Plant Protection" (for the needs of the Department of Microbiology).

Reviewer: Professor Dr. Nasya Borisova Tomlekova, Maritsa Vegetable Crops Research Institute, Plovdiv, professional area 6.1. Plant Breeding, appointed as a member of the scientific jury by Order No. RD16-1186/22.10.2024 from the Rector of the Agricultural University.

1. General Information on the Candidate's Career Development:

Dr. Mariana Krasimirova Petkova completed her Master's degree in "Agroengineering – Plant Protection" at the Agricultural University of Plovdiv in 1997. In 2002, she defended her Ph.D. in Molecular Biology at Kobe University, Japan, with the dissertation topic "Structure and Function of Novel Cytochrome P450 Types in Higher Plants." From 2003–2006, she worked as a postdoctoral researcher at Osaka University, Japan, on cloning and functional analysis of genes involved in chromatin remodeling.

Since 2010, Dr. Petkova has worked as an Assistant Professor and later as a Senior Assistant Professor in the Department of Genetics and Selection at the Agricultural University of Plovdiv, teaching courses such as Genetics, Molecular Genetics, and Recombinant DNA Technology. She led a project on improving rapeseed oil quality and specialized at North Dakota State University, USA, in 2014.

Since 2014, she has been a Senior Assistant Professor in the Department of Microbiology and Ecological Biotechnology, teaching Microbiology and creating a master's-level course in Molecular Methods in Plant Protection. She actively develops her expertise in molecular analysis methods, biochemical analytical techniques (HPLC), food and raw material traceability, and metagenomic technologies.

2. Overview of Submitted Materials:

For the "Associate Professor" competition, Dr. Petkova submitted 43 scientific works, categorized as follows: 41 works in the specialized area of the competition, of which 39 are relevant for evaluation:

- 2 publications related to her Ph.D. thesis (not subject to evaluation);
- 20 publications in impact-factor journals (minimum required: 10), achieving 119.5 points (required: 100);
- 15 papers in peer-reviewed journals;
- 6 conference papers.

Her individual contribution is evident: one solo-authored publication, first authorship in 18 papers, second authorship in 9, and third or subsequent authorship in the remaining 13. The publications include 3 in Q1, 7 in Q2, 3 in Q3, and 7 in Q4 journals, with a cumulative impact factor of 34.824. This demonstrates significant scientific contributions.

Dr. Petkova has provided all required documents and information per Bulgarian academic regulations. Her total score of 632.3 exceeds the national minimum by 232.3 points, mainly due to higher performance in categories B, G, and D relevant to this competition.

The citations of Dr. Petkova's works in scientific publications, indexed in world-renowned scientific databases, or in monographs and collective volumes, amount to 86 citations, exceeding the required 50. Citations in peer-reviewed monographs and collective volumes specifically account for 33 citations.

3. Main Research Directions of the Candidate

Demonstrated Skills or Potential for Leading Research (project management, securing external funding, etc.)

The primary research interests of **Assistant Professor Dr. Mariana Petkova** focus on **plant protection and microbiology**, with diverse applications in agriculture and ecology. Her studies aim to develop sustainable biological solutions for advancing healthy and eco-friendly technologies, with an emphasis on the sustainable management of agricultural resources through biological control, plant growth stimulation, and improving the quality of agricultural production. Her research spans **four main directions**:

1. **Molecular and biochemical identification and in vitro testing** of the applicability of beneficial microorganisms against phytopathogens and pests.
2. **Next-generation sequencing** for microbiome analysis of various soils and composts.
3. Interactions between beneficial microorganisms and plants to develop **biological approaches** to plant protection and maintain soil health.
4. **Preservation and conservation** of rare plant species.

These studies play a key role in the sustainable and eco-friendly development of agriculture. From **2014 to 2024**, Dr. Petkova has led **four internal projects** funded by the Agricultural University and **one international project** under the "Interreg Balkan-Mediterranean" program. She has also participated in **three additional internal projects, two national projects, and two international projects**. Her involvement in international research projects and collaborations has significantly contributed to enhancing the global recognition of the Agricultural University.

4. Evaluation of the Candidate's Pedagogical Preparation and Activity

Role in Training Young Researchers

Assistant Professor Dr. Mariana Petkova is actively involved in teaching activities at the Agricultural University, delivering lectures and practical sessions in the following areas:

- Courses such as **Microbiology, Ecology of Microorganisms, and Microbial Preparations in Horticulture**.
- A specialized course titled **Molecular Methods in Plant Protection** for the bachelor's program in Plant Protection.
- She has also developed a curriculum for the master's-level course **Molecular Methods for Analysis in Plant Protection**.

From **2019 to 2024**, Dr. Petkova conducted a total of **4,348.3 teaching hours**, meeting the required teaching load standards.

During the same period, she supervised **seven theses** for students in the bachelor's and master's degree programs, who have subsequently applied their knowledge and skills in professional practice.

Since **2016**, she has served as a **coordinator for the Erasmus+ program**, supporting students in their orientation and participation in the university's scientific activities.

5. Significance of the Achieved Results, Proven by Citations, Publications in Prestigious Journals, Awards, and Membership in International and National Scientific Organizations

Dr. Petkova's consistent work on scientific projects and publications demonstrates a sustained interest and dedication to research. Her studies have been published in internationally peer-reviewed journals indexed in **Scopus** and **Web of Science**, highlighting the quality and impact of her research.

Her publications have been cited **121 times**, with **86 citations** in impact-factor journals, underscoring their importance to scientific development. She has presented **seven reports** at national and international conferences.

The scientific developments she has presented at conferences and seminars contribute to their dissemination among the academic and professional communities, enhancing their recognition and practical applicability.

6. Significance of Contributions to Science and Practice

Motivated Response to Whether the Candidate Has a Well-Defined Research Profile

Dr. Mariana Petkova demonstrates a profound and interdisciplinary approach in her research, combining innovative methods with practical applications in microbiology, plant protection, and ecology. Her work reveals significant and original contributions:

Some of Dr. Petkova's major scientific contributions include the discovery of antimicrobial activity in beneficial microorganisms against phytopathogens and the effects of entomopathogenic fungi on pests. She has also developed methodologies for screening microorganisms of biotechnological importance and created collections of beneficial microorganisms for future agricultural applications.

Her research achievements cover critical and relevant scientific areas such as beneficial microorganism studies. Molecular identification and biochemical characterization, including the application of advanced technologies like Real-Time PCR for identifying lactic acid bacteria, yeasts, and entomopathogenic fungi (*Beauveria* species), are crucial for enhancing the precision and speed of identification processes. This accuracy is essential for discovering new biological agents with potential applications. Studies show that *Beauveria bassiana*-inoculated plants produce auxins, leading to improved protection against the Colorado potato beetle. The focus on advanced molecular methods highlights the high precision of her research, while her work with diverse microorganisms expands opportunities for identifying new species with varied functionality. Some of her studies involve metagenomic analyses of microbial communities, uncovering their interactions and ecological roles. As part of a project on the sustainable use of wild plant species in the Strandzha Nature Park, Dr. Petkova explored the microbiome in the rhizosphere of the endemic chickpea species (*Cicer montbretii*), linking these microbiomes to their geographical origins. Her research on antimicrobial activity focuses on the potential of microorganisms to control phytopathogens and pests in agriculture. Special emphasis is placed on bacteriocins and enzymes with practical applications. These studies demonstrate some clear orientation toward specific and applicable products that could find use in biological control, critical for sustainable agriculture. She has also investigated the microbiome of soils and compost, uncovering new approaches to sustainable agroecosystem management.

Dr. Petkova's scientific interest in the conservation of endangered wild plant species of economic importance contributes to biodiversity and agriculture.

Dr. Petkova's work has received international recognition through research publications, presentations, and collaborations, establishing the Agricultural University's role on the global stage.

Key Methodological Contributions

The development of molecular identification and characterization of microorganisms, as well as the creation of molecular-genetic approaches for isolating and analyzing microorganisms, plays a key role in identifying strains with biotechnological potential. Gene expression analysis expands knowledge of the mechanisms of amylolytic activity, while the screening of highly efficient bacteria and yeasts offers new prospects for their application in sustainable agriculture.

Complex analysis of soil systems: The physicochemical and microbiological analysis of rhizosphere soils reveals important interactions between plants and microbes, with potential for managing soil health. The metagenomic approach contributes to a better understanding of microbial composition, while the comparative analysis of soils from habitats of rare species from the Fabaceae family provides a foundation for biodiversity conservation.

Optimization and implementation of innovative technologies: The development of a method for producing whole-grain sourdough with a long shelf life successfully demonstrates the combination of traditional and modern technologies aimed at improving food products. The use of spectroscopy and machine learning complements these approaches with high-precision analysis of plant samples. The creation of specialized collections of bacteria and yeasts with industrial applications, along with the deposition of strains in genetic banks, provides resources for long-term research. These efforts strengthen the capacity for the storage and management of microbial diversity and contribute to **genetic and microbial resources**.

Testing for effectiveness and sustainability: The application of in vitro tests for the suppression of phytopathogens demonstrates the effectiveness of beneficial microorganisms in combating economically significant diseases such as those caused by *Botrytis cinerea* and *Pseudomonas syringae*. Research on the effects of gamma irradiation provides additional data on the resilience of plant systems.

Sustainable agriculture and biodiversity conservation: Studies on the interactions between microorganisms and plants form the foundation for optimizing biofertilizers and biostimulants. At the same time, the identification and conservation of endangered species like *Cicer montbretii* and *Lupinus albus* emphasize the importance of an ecological approach to agriculture. The methodological contributions highlight the innovative nature of the research and their applicability in developing sustainable practices, while also establishing the institution as a leader in the field of microbiology and agricultural sciences.

The **scientific contributions** of Dr. Petkova's work expand knowledge in microbiology, biotechnology, and sustainable agriculture, providing solutions to fundamental and applied challenges.

The **identification and characterization of microorganisms** include: Molecular characterization of lactic acid bacteria with amyolytic and bacteriocin-producing activity for biotechnology and the food industry; Discovery of yeasts and bacteria that enhance plant productivity through rhizosphere interactions; Isolation of endophytic microorganisms resistant to herbicides, with potential for biodegradation of toxic compounds.

Microbial biotechnology has been further developed with: Development of biopreparations using bacteria and yeasts to suppress plant pathogens and stimulate crop growth; Optimization of the process for synthesizing bacteriocins; Implementation of biopreparations for sustainable agriculture, improving crop yields and quality.

Microbial-rhizosphere interactions involve: Studying the interactions between microorganisms and plants that enhance resistance to stress factors; Identifying key metabolic and genetic mechanisms in these interactions to create biostimulants.

Genetic and microbial collections include: Depositing new strains in international databases, expanding the global microbial collection; Developing standardized methods for the storage and analysis of genetic material.

Sustainable development and ecology involve: Identifying rare and endangered species from the Fabaceae family with agricultural potential; Implementing biological alternatives to reduce chemical fertilizers and pesticides; Investigating the effects of gamma irradiation on the resistance and preservation of plant products.

Contribution to the **innovations in food technology** are: Developing whole-grain sourdough with a long shelf life (patent BG 3805 U1); and New fermentation technologies for products with high nutritional value and functional benefits.

Dr. Petkova's scientific contributions strengthen institutional capacity in biopreparations and food technologies, while expanding international collaboration through the deposition of unique microbial collections in global databases. These efforts support long-term research and innovation. Dr. Petkova actively promotes sustainable practices for reducing chemical footprints in agriculture

and improving agroecosystems. The implementation of new technologies in the food industry provides economic and social benefits, contributing to the sustainable development of the sector.

Applied Contributions of Assistant Professor Dr. Mariana Petkova

Dr. Petkova's applied contributions relate to the development of sustainable and innovative solutions for agriculture and ecology, with direct applications in practice:

The **development of biopreparations for sustainable agriculture** includes the creation of biopreparations with bacteria and yeasts that enhance plant growth, improve resistance to stress factors, and reduce the need for chemical fertilizers and pesticides. Also important is the implementation of innovations such as whole-grain sourdough with a long shelf life and functional properties, as well as a patented utility model (BG 3805 U1).

The **use of microorganisms for ecological purposes** involves the biodegradation of toxic compounds and the reduction of pollution through microorganisms that break down organic and inorganic pollutants.

Dr. Petkova **stimulates organic farming** by using microorganisms to increase nitrogen fixation, improve soil fertility, and promote the growth and resistance of crops with ecological and economic significance.

In **improving methods for the storage of plant products**, she has applied gamma irradiation to extend shelf life, thereby improving the quality of agricultural produce.

Contributions to the **creation of microorganism databases** include the deposition of microorganisms in internationally recognized collections and the standardization of processes for storing and utilizing genetic resources, which facilitates access for future scientific research.

7. Critical Remarks and Recommendations

Recommendations regarding the entire scientific and applied work of Dr. Mariana Petkova:

Although Dr. Petkova focuses on biotechnology, microbiology, and sustainable agriculture, future research could be enriched by deeper integration of other disciplines, such as genetics. Expanding interdisciplinarity could help improve the understanding of interactions between microorganisms and plants, as well as integrate innovations.

Despite the successes in developing biopreparations and food technologies, it is important to focus on optimizing these processes for their broader and more efficient implementation in industrial practice. It is recommended to conduct more research on the economic efficiency and sustainability of these technologies at different stages of the production process.

Although the application of biopreparations and new technologies has significant potential for the sustainable development of agriculture and the food industry, more attention should be given to the long-term sustainability of these solutions in the future. Long-term studies should be conducted on their impact on ecosystems and their adaptability to changing climatic conditions.

To ensure that research and innovations are more effectively applied in the real sector, it is important to establish stronger partnerships with industrial partners as well as with organizations involved in sustainable agriculture and biotechnology. It is recommended to organize joint projects and initiatives that will accelerate the implementation of new technologies.

Although Dr. Petkova actively participates in international scientific initiatives, there is significant potential for expanding collaboration with other scientific and research institutions worldwide. It is recommended to expand scientific networks in the future to exchange knowledge and experience in overcoming global challenges related to sustainable agriculture and biotechnology.

It is recommended that Dr. Petkova continue to mentor young researchers in these fields through her teaching and guidance. This will contribute to building a new generation of scientists who will continue the work in these innovative and important areas that she is developing at the Agricultural University.

Questions Regarding the Methodology and Practical Significance of the Research:

1. The application of Real-Time PCR is commendable. Please ask Dr. Petkova to analyze why this technique is preferred over other alternatives, what specific successes have been achieved with it, or how it contributes compared to traditional methods. What are the other contemporary methods that could alternatively be applied, including their advantages and limitations? Please ask Dr. Petkova to clarify the degree of innovation and practical applicability.
2. Please ask the candidate to consider the possible challenges in applying biological agents, such as pathogen resistance or regulatory requirements. Focusing on the practical potential, Dr. Petkova should discuss the barriers to transforming scientific discoveries into real-world solutions. What is the potential for the discovered agents to transition into commercial production, and will they face technical and regulatory obstacles?

8. Personal Impressions and Opinion of the Reviewer

I have known Assistant Professor Dr. Mariana Petkova personally since 2011. Our professional acquaintance dates back to her participation in an intensive course on "Application of HPLC for Quality Assessment of Plant Products," held in Budapest, Hungary. The course was organized within the framework of the regional TC project RER/5/013, funded by the International Atomic Energy Agency (IAEA), where I was the coordinator.

My impressions from the materials provided for the competition further confirm her excellent scientific reputation. Assistant Professor Dr. Mariana Petkova demonstrates an exceptional ability to integrate knowledge from diverse fields such as agronomy, molecular biology, chemistry, and ecology. This interdisciplinary expertise allows her to develop innovative solutions to complex scientific and practical challenges.

Her professional profile is clearly defined and impressive, with valuable contributions to both the theoretical development of science and the practical application of knowledge in the field of plant protection.

CONCLUSION

Based on the analysis of the candidate's pedagogical, scientific, and applied work, I believe that Assistant Professor Dr. Mariana Krasimirova Petkova meets the requirements of the Higher Education Act, the Regulations for its application, and the Agricultural University of Plovdiv's Statute.

All of this gives me grounds to give a **POSITIVE** evaluation of her overall work. I also suggest that the esteemed Scientific Jury vote positively and that the Faculty Council of the Faculty of Plant Protection and Agroecology at the Agricultural University of Plovdiv elect Dr. Petkova as "**Associate Professor**" in the scientific specialty "**Plant Protection**".

Date: December 12, 2024
Plovdiv

Reviewer:
(Prof. N. Tomlekova)