



## REVIEW

**Regarding:** competition for a "Professor" in the scientific specialty Ecology and ecosystem protection, announced in SG no. 62 of 21.07.2023

**Candidate:** Associate Professor Dr. Stefan Ivanov Shilev

**Reviewer:** Prof. Dr. Maya Lazarova Nustorova - Kitanova, area of higher education 4. Natural sciences, mathematics and informatics, professional direction 4.4. Earth sciences, scientific specialty Ecology and ecosystem protection - member of the Scientific Jury according to Order No. RD 16-898/25.09.2023 of the Rector of the Agricultural University - Plovdiv

### 1. General data on the candidate's career and thematic development

Candidate Assoc.Prof. Dr.Stefan Shilev was born in 1973 in the city of Plovdiv. In 1996 graduated from the Higher Agricultural Institute, Plovdiv, majoring in Agroengineering - Plant Protection at the Faculty of Plant Protection and Agroecology and obtained a Master's degree in agricultural engineering. In 1998 joined the Agricultural University, Plovdiv, Department of Microbiology and Environmental Biotechnologies as an assistant. In the same year, he specialized in the Faculty of Biology of the Sofia University "St.Kliment Ochridski" and later in Spain, the University of Cordoba (1999-2000). In the period 2000-2003 is a doctoral student at the University of Córdoba, where he defended his dissertation and obtained a PhD. Since 2010 is an "Associate Professor" at the Department of Microbiology and Environmental Biotechnologies at AU - Plovdiv. Before taking up the academic position of "Associate Professor", the candidate has a number of specializations that have a certain contribution to his professional and creative development as a researcher - specialization in the Czech Republic, the city of Trest (NATO, Phytoremediation of contaminated soils - 2002), specialization at the University of Cordoba, Spain (Bacterial Proteomics - 2007), Croatia. Participated as a lecturer in a training course on NATO (Uncertainty in environmental modeling and consequences for policy decisions - 2007), a training course TS2 Waste, EK (STaR The city of the future: Moving from waste management to resource management - 2007), training courses on European programs and projects (Italy, Germany, Spain).

The professional career of the candidate at AU is connected with holding elected positions - member of the Academic Council (2007-2011 and 2020 to date), Chairman of the General Assembly (2020-2021), member of the Erasmus program committee at the Faculty of Plant Protection and Agroecology (since 2020), member of the Eligibility committee under professional direction 4.4 Earth Sciences in AU (since 2020), member of the Board of the Center for Scientific Research, Technology Transfer and Intellectual Property Protection (since 2020), member of the Temporary Scientific Expert Commission at the National Scientific Research Fund under professional direction 4.4 Earth Sciences (2021 and 2023).

He is a participant in national and international organizational and scientific committees of a number of scientific forums.

As an expert, over the years the candidate Associate Professor Stefan Shilev held public positions - Director of the Directorate of Ecology and Waste Management, Municipality of Plovdiv (2012 - 2014); Director of the Regional Environment and Water Inspection, Plovdiv (2014-2020); Member of Parliament in the 47th and 48th National Assembly of the Republic of Bulgaria.

## **2. General description of the presented materials**

Out of a total of 68 scientific papers presented in the nomenclature specialty, in the competition for "professor" Assoc. Prof. Stefan Shilev participated with a total output of 27 papers, which I accept for review, as follows:

### **A. Scientific publications on the nomenclature specialty - 26**

I present a description of the indicators performed by the candidate, related to the scientific production and laid down in Law for the Development of the Academic Staff in Republic of Bulgaria:

Indicator B4: Habilitation work - scientific publications (not less than 10) referenced and indexed in world-famous databases with scientific information - 10;

Indicator G7: Scientific publication in publications that are referenced and indexed in world-renowned databases with scientific information – 10;

Indicator G8: Scientific publication in non-refereed journals with scientific review or in edited collective volumes – 5;

Indicator G9: Published chapter of collective monograph – 1.

### **B. Study Guide – 1:**

Sapundzhieva Kr., S. Shilev, M. Naydenov, Y. Kartalska. 2010. Manual of microbiology, AIAU, AU, Plovdiv.

The first group (indicator B4) includes, out of a total of 10, 5 scientific publications in journals with IF (2, 3, 7, 9, 10) and 5 publications in scientific books indexed in Scopus (1, 4,



5, 6, 8 ). Publications with IF are in prestigious international journals - J. of the Science of Food and Agriculture (2 – IF 4,1); J. of Environmental Management (3 – IF 8.7); Microorganisms (7 – IF 4.5); J. of Environmental Protection and Ecology (9 – IF 0.507); Indian J. of Agricultural Research (10 – IF 0.258). Of the publications in scientific books indexed in Scopus, 3 (1, 5, 6) are Springer publications (publication 1 - in Springer - Series: Integrating Safety and Environmental Knowledge Into Food Studies towards European Sustainable Development; 5 - in Springer Singapore - Series: Rhizosphere, Microbiome and Agro-ecology; 6 - in Springer Singapore - Series: Research Trends, Priorities and Prospects); 1- in collective volume (8 - Microbial Management of Plant Stresses: Current Trends, Application and Challenges); 1- in Proceedings of scientific forum (4).

The second group (indicator G7) includes 10 scientific publications, of which 7 (11, 13, 15, 16, 17, 18, 19) in journals with IF - J. of Environmental Protection and Ecology (11, 17 – IF 0.507); Emirates J. of Food and Agriculture (13 - IF 1,1); J. of Chemical Technology and Biotechnology (15 - IF 3,4); Applied Sciences (16, 18, 19 – IF 2.7). The rest are published by Springer (12 - in Springer India-N. K. Arora (ed.) Plant microbe symbiosis – fundamentals and advances) and scientific journals - Acta microbiologica bulgarica (14), Ecologia balkanica (20 - under print).

The third group (indicator G8) includes 5 publications - in proceedings of national and international scientific forums (22, 23, 25), in a collective scientific issue (21) and a scientific journal (24).

Chapter of a collective monograph (indicator G9) - 1 publication: Phytoremediation of metal contaminated soils for improving food safety, pp. 225-242, In: Costa R. and K. Kristbergsson (Eds.) "Predictive modeling and risk assessment", Series: Integrating Safety and Environmental Knowledge into Food Studies towards European Sustainable Development, Springer.

The published chapter of a collective monograph presents a current scientific and ecological problem - technologies for phytoremediation of soils contaminated with heavy metals and impact on soil microflora with risk assessment and use of mathematical models.

Publications 1, 11, 22, 23, 26 were issued before the candidate's habilitation in 2010.

Summarized by significance, the scientific works of Assoc.Prof. Stefan Shilev can be presented:

- Publications in journals with IF - 12, which represents a serious 46% of scientific production;
- Publications in peer-reviewed and refereed scientific journals – 8;
- Publications in non-refereed journals with scientific review and edited scientific volumes – 5;
- Chapter of a collective monograph – 1.

Assoc.Prof. Stefan Shilev's personal involvement in the presented 26 scientific publications can be demonstrated by the fact that 3 of them are independent and in 11 he is the first author, which represents 54% of the candidate's total scientific output. Of the remaining publications, he is the second author in 3 and the third and subsequent author in 9.

It can be summarized that criteria B and G of the requirements of Law for the Development of the Academic Staff in Republic of Bulgaria and the Regulations for the Implementation of the Law are exceeded, respectively by more than 40% and 30%.

In the years following the acquisition of academic position "Assoc.Prof.", the candidate participated in 6 international scientific forums (with a total of 8 posters and reports) and 9 national ones (with a total of 17 reports and posters). He has 70 reviews for IF journals and three appearances as a guest editor for IF journals (Land, Sustainability, Microorganisms).

### **3. Main directions in the candidate's research work. Demonstrated skills or aptitude for leading scientific research (project management, attracted external funding, etc.)**

The main directions in the research work of Assoc.Prof. Shilev are several - phytoremediation of soils contaminated with heavy metals based on specific microorganisms - stimulators; use of bacterial populations to overcome plant stress under the influence of abiotic environmental factors; utilization of sludge and biowaste through composting.

The scientific problems developed by the candidate are linked to activity as a leader and participant in a number of international and national scientific projects - he is the leader of 5 national scientific projects (financed by National Fund of Scientific Research - 3 and AU - 2). Two of the projects (1 and 4, according to Document 6) are from the period before the acquisition of academic position "Assoc.Prof." (2010), but not reflected in the National Centre for Information and Documentation (NACID). During this period, the candidate is the head of 7 international scientific and educational projects under COST, Erasmus+, Horizon 2020, Horizon Europe, NATO, ERA-NET, European Environmental Agency programs. Project 5 from this list has a deadline for completion before the candidate's first habilitation and is also not included in the NACID. As a team member, Assoc.Prof. Shilev indicates participation in 5 national projects, two financed by the National Fund of Scientific Research, one by the Ministry of Education and Science and one by the AU (also before 2010).

The scientific and creative activity of the candidate is also clearly illustrated by the high amount of funds attracted for AU from projects of which he is the head - more than BGN 660,000.

### **4. Evaluation of the pedagogical preparation and activity of the candidate. Its role in the training of young scientific personnel**

Assoc.Prof. Shilev is the author of 9 programs for the Bachelor's degree program and 6 for the Master's degree program (new or updated), as well as 2 programs in a foreign language under



the Erasmus Program, according to the attached reference from AU. At the Bachelor's degree has taught (as in the current academic year 4 disciplines) the disciplines of Microbiology (for Agronomy, Hydromelioration, Organic Farming majors ); Ecology of microorganisms (for Ecology and environmental protection, Plant Protection majors); Waste management (a new discipline developed for the Ecology and environmental protection major); Utilization of agricultural waste (a new discipline developed for Ecology and environmental protection and Organic Farming majors); Solid waste processing technologies (Ecology and environmental protection); Approaches to the purification of agroecosystems (Organic Farming major); Biodegradation and bioremediation (Agroforestry ecosystems and mountain agriculture major). For Master's degree: Microbiology (Plant Protection and Plant Medicine majors); Waste management (Ecology of settlement systems major); Circular economy and utilization of resources (Ecology of settlement systems major); Municipal environmental programs (Ecology of settlement systems major); Microbial communities of environmental components (Protection of biological diversity major); Processing and recycling of biomass (Bioeconomy major). The disciplines under the Erasmus Program are for Bachelor's degree - General Microbiology and Environmental Microbiology.

The approved programs themselves are not attached, which is not a required condition, but can give a clearer picture of the candidate's profile as a teacher.

Assoc.Prof. Shilev's teaching activity is complemented by his participation in the training of young scientists - he is the supervisor of 4 doctoral students, two of whom have defended, 1 has been assigned with the right to defend and 1 is in the process of training, as well as 16 graduate students - 12 for Bachelor's degree and 4 for Master's degree.

## **5. Significance of the obtained results, proven by citations, publications in prestigious journals, awards, membership in international and national scientific bodies, etc.**

In the materials for the competition, an impressive number of citations are stated - a total of 620 (currently 724 in Scopus) of publications from before and after holding the position of Associate Professor, mostly in international journals. Some of them (147 citations of 8 publications) are presented in a list (Document 9). For the rest of the citations, a link to Scopus is indicated. A large part of the citations (over 450) are after holding the title of Associate Professor (Scopus), which indicates a sustained high interest of the international scientific community in the topics and problems investigated in the works of Assoc.Prof. Shilev. This is also supported by the fact that one of the independent publications of the candidate from 2020 (16) has 62 citations to date. All citations are in international refereed and indexed editions, which is presupposed by the fact that a significant part of the candidate's scientific works, as indicated - 12 in total, are in editions with IF.

I accept the multiple refulfillment of this indicator (group G) as an expression of significance of the applicant's main scientific developments.

## **6. Significance of contributions for science and practice. A motivated answer to the question to what extent the candidate has a clearly defined profile of research work**

Candidate Assoc.Prof. Shilev presents the results of his scientific and research activities in 6 thematic directions with structured contributions to each of them, which can be summarized:

### **I. PHYTOREMEDIATION OF SOILS CONTAMINATED WITH HEAVY METALS WITH THE PARTICIPATION OF BENEFICIAL MICROORGANISMS**

The first scientific direction includes the results of research reflected in 8 publications (2, 11, 12, 14, 15, 21, 23, 26). Three of the publications (2, 11, 15) are in IF journals (respectively IF 4.1, 0.507, 3.4), 1 – in Springer (Scopus) (12), 1 – in an edition referred to in Scopus (14), 1 – in Proceedings of a scientific forum (23), 1 chapter of a monograph (26), 1 chapter of a collective work (21). Part of the research is within the framework of scientific projects financed by 5 national and international projects. In the direction, the candidate presents 8 scientific and 2 scientific-applied contributions, which I consider to be correct and can be summarized: the limits of application of mining sediments in sunflower cultivation are defined (21); the effect of multi-component metal contamination of the soil on the accumulation of heavy metals with microbial participation in autochthonous and cultural plants was established with a view to applying targeted phytoremediation of contaminated terrains (26); the pathways for microbial transformation of toxic elements in the rhizosphere in symbiosis with plants were analyzed, as well as the role of rhizosphere microflora in plant development (2, 12); the role of combined application of organic ameliorants (compost) and active bacterial populations to reduce the impact of heavy metal pollution on the development of agricultural crops is proven (15); tolerance has been demonstrated and *Sach.cerevisiae* strains have been characterized to As and Cd contamination, which is a potential for their use in phytoremediation (11,14). As a scientific-applied contribution, the results of a study on the accumulation of heavy metals in vegetable crops at different distances from an industrial source of pollution and the recommendation that specific crops should not be grown in areas around industrial sites can be cited (23).

### **II. APPLICATION OF BENEFICIAL MICROORGANISMS TO IMPROVE AGRICULTURAL CROP GROWTH AND YIELD**

The direction includes results of research and analysis, reflected in 8 scientific publications (3, 6, 7, 8, 10, 13, 16, 25), some of them financed by the Scientific Research Fund, AU, Ministry of Education and Science. 3 scientific and 2 scientific-applied contributions were presented.

I define this direction in the candidate's research work as significant and with important contributions to science (including methodological) and practice, insofar as it includes 5 publications (3, 7, 10, 13, 16) in journals including those with a high IF (respectively 8.91, 4.5, 0.258, 1.1, 2.7) and multiple citations (including 62 for publication 16). Two of the publications are reviews (Scopus - 6, 8) and 1 – in a proceeding of a scientific forum (25).



Scientific contributions in the direction are related: proven reduced salt stress in sunflower by inoculation with strains of *Pseudomonas* spp. (3); a *Candida* strain with high phytase activity was selected for subsequent use in the feed industry (13). Three of the publications have scientific and methodological contributions, insofar as they consider the latest achievements in biotechnology on the role of soil microorganisms on the status of soils and plants, overcoming stress in plants due to salinity and drought (6, 8,16).

With a certain scientific and methodological contribution, I find the in-depth review and analysis on the problem of applying beneficial microorganisms (biofertilizers, biopesticides) as an alternative to pesticides and chemical fertilizers (7). Research on changes in the quantitative and qualitative composition of the soil microflora when applying organic, mineral and combined fertilization can be defined as scientific and applied contributions (10, 25).

### III. RECOVERY OF BIO-WASTE THROUGH COMPOSTING

The direction includes research results reflected in 5 scientific publications (1, 5, 17, 19, 24), two of which in journals with IF 0.507 (17) and IF 2.7 (19). Three of the publications are review works - 2 in Springer, referenced in Scopus (publications 1 and 5 - part of collective volumes) and 1 publication (24) in a specialized journal on bioeconomy. The studies are pioneering for AU and are funded by doctoral programs, the Ministry of Education and Science and state institutions. 6 scientific, 3 scientific-applied and 1 applied contributions are submitted to the direction, which I accept.

I consider the review articles with a certain scientific contribution - analysis of technologies for composting agricultural and food waste and subsequent application of the compost (1); a comprehensive study on the biological treatment of domestic wastewater treatment plant sludge and its management, including models for agricultural sludge utilization and bioremediation (5); bio-waste processing and product application in the context of EU circular economy policies (24). The specific results obtained from different options for composting and vermicomposting of sewage sludge (17) also make a scientific contribution; used a metagenomic approach to determine and dynamics of molds and their enzymatic activity in composting different substrates (19). The developed technology for vermicomposting sludge from wastewater treatment plants has been applied in three municipalities, which I accept as an important applied contribution of scientific development.

### IV. NEXT-GENERATION SEQUENCE IN INVESTIGATING CHANGES IN THE SOIL AND COMPOST MICROBIOME

I accept the developments in this direction rather as an organic part of direction III, insofar as they are scientific, methodological and original contributions to its thematic research field. The direction includes research reflected in 3 publications (18, 19, 20), one of which is reflected in direction III (19). Two of the articles (18, 19) were published in a journal with an IF of 2.7 and one is in press, also in a journal with an IF (20). 2 scientific, 3 scientific-applied and 1 methodical contributions were presented. Summary: a metagenomic approach was pioneered to determine the species diversity and dynamics of molds (19) and bacteria (18, 20) in the microbiome during the separate phases of composting and vermicomposting of

substrates of different origins (sediment and biodegradable waste). The studies also have a methodological contribution, insofar as such an approach is applied for the first time to characterize compost materials.

## V. CLIMATE CHANGE AND ENVIRONMENTAL PROTECTION

Results of studies included in 2 publications (4, 9) are presented, one in a journal with an IF of 0.507 (9) and the second in a proceeding of an international scientific forum (Scopus). 2 scientific, 1 scientific-applied and 1 applied contribution are presented: an analysis of long-term monitoring of atmospheric air quality in the city of Plovdiv as a component of the environment based on a database from the Air Quality Management System (4); the possibilities of reusing reclaimed water in agriculture were investigated (publication 9, within the framework of two international projects and as part of the Strategic Objective "Green and Competitive Economy" in Bulgaria).

## VI. EDUCATION

From this direction, I consider the creation of a new direction at AU - Plovdiv as an original contribution to the development of higher education in our country, namely, a new discipline "Waste Management" developed by the candidate.

## 7. Critical notes and recommendations

The curricula of the disciplines taught by Assoc.Prof. Dr. S.Shilev, including author's, are missing.

Recommendation - issue of a textbook in the main discipline of which the candidate is a holder.

## 8. Personal impressions and opinion of the reviewer

I have no personal impressions of Associate Professor Dr.Stefan Shilev. I form my opinion based on an analysis of the scientific production presented and the creative and professional realization of the candidate. I consider Associate Professor Dr.Stefan Shilev to be a scientist and teacher who has successfully built up over the years, enjoying authority among the scientific and professional community, which is reflected in the numerous citations of his scientific works and the elected positions he holds.

## CONCLUSION

Based on the presented analysis of the candidate's pedagogical, scientific and scientific-applied activities, I believe that , Assoc.Prof. Dr.Stefan Ivanov Shilev meets the requirements of the Law for the Development of the Academic Staff in Republic of Bulgaria, and the Regulations for the Implementation of the Law on the Development of the Academic Staff at the Agrarian University. Assoc.Prof. Dr. Shilev is an established scientist with high expertise and authority in the scientific communities at home and abroad, has a serious scientific



output, cited in a large number of international publications, with activity as a leader and participant in a number of international and national research and educational projects and not least with active teaching activities, including training of young researchers.

All this gives me the reason to positively evaluate his overall activity and to suggest with conviction to the honorable Scientific Jury to also vote positively, and the Faculty Council of the Faculty of Plant Protection and Agroecology at the Agrarian University - Plovdiv to elect Assoc. Prof. Dr. Stefan Ivanov Shilev for "Professor" in the scientific specialty Ecology and Ecosystem Protection.

Date: 2.11.2023

Plovdiv

REVIEWER:



(Prof. Dr. Maya Nustorova-Kitanova)