



## REVIEW

**by Associate Professor Dr. Ventsislava Yankova Petrova  
Sofia University "St. Kliment Ohridski" - Faculty of Biology  
of the materials submitted for participation in competition for  
"ASSOCIATE PROFESSOR"**

**in the field of higher education 4. Natural sciences, mathematics and informatics;  
professional field 4.3. Biological sciences; scientific specialty  
"ECOLOGY AND ECOSYSTEMS` PROTECTION" (Ecology of microorganisms)**

### **1. General presentation of the procedure**

The competition for "Associate Professor" in the field of Higher education 4. Natural sciences, mathematics and informatics, professional field 4.3. Biological sciences, scientific specialty "Ecology and ecosystems` protection" (Ecology of microorganisms) has been announced for the needs of the Department "Ecology and Environmental Protection" at the Faculty of Biology of Sofia University "St. Kl. Ohridski" in SG no. 88 of 13.10.2020. In this competition, as only candidate submitted documents is Dr. Silvena Boteva Boteva, Assistant Professor in the Department "Ecology and Environmental Protection" at the Faculty of Biology, Sofia University "St. Kliment Ohridski".

The presented set of materials on digital media comply with the requirements of the Act for the Development of the Academic Staff in the Republic of Bulgaria (DASRBA), Regulations for the Implementation of the Act for the Development of the Academic Staff in the Republic of Bulgaria (RIDASRBA) and the Rules on the Conditions and Procedure for Acquiring Science Degrees and Holding Academic Positions in Sofia university "St. Kliment Ohridski", as exceeding the recommended criteria for holding the academic position "Associate Professor" in Professional Field 4.3. Biological sciences. The documentation for the competition is well organized and fully reflects the versatile research and teaching activities of the candidate.

### **2. Brief biographical data**

Assistant Professor Dr. Silvena Boteva was born on March 10, 1982. In 2000 she entered as a full-time student at the Faculty of Biology at Sofia University "St. Kliment Ohridski", who graduated in 2004 with a bachelor's degree in "Ecology and Environmental Protection". In 2006 she successfully completed a master's degree in the Master Degree Programme "Protection of the Natural Environment" at the Faculty of Biology of Sofia University "St. Kliment Ohridski". She defended her PhD degree on "Structure and functions of bacterioplankton from the circus of the Seven Rila Lakes - Rila National Park" in 2009 in the Department of Ecology and Environmental Protection, Faculty of Biology, Sofia University "St. Kl. Ohridski". In 2009 she started her career as an expert ecologist in the company EnviroTech Ltd., where she prepared reports for environmental impact assessment. In 2014 she was appointed as an expert ecologist at the research sector at the

Technical University, where she began her teaching career and her participation in the training of students in the field of EIA and complex permits. Since 2014 until now, the candidate holds the position of Assistant Professor in the Department of Ecology and Environmental Protection at the Faculty of Biology, Sofia University "St. Kliment Ohridski".

### **3. General presentation of scientific papers**

Assistant Professor Boteva presented a list of publications for all her scientific activity, a total of 31 scientific papers: 2 chapters from books, 25 articles in peer-reviewed journals and 4 articles in non-refereed journals. Publications presented in this competition are distinguished from those used in previous procedures. The publications were cited 131 times: 65 times in publications referenced in Scopus and Web of Science and 66 times in other publications. The Scopus scientific database contains 21 of the publications, with 93 citations. According to the same database, the candidate's h-index is 4.

24 scientific papers are presented in the competition for the academic position "Associate Professor". From this list, 5 scientific publications are in journals that are referenced and indexed in world-renowned databases of scientific information and are equated to habilitation in group B4 (distributed by quartiles: Q1 - 2, Q2 - 3). Outside the habilitation, group G includes 19 publications, of which 14 are referenced and indexed in world-renowned databases of scientific information Web of Science or Scopus (distributed by quartiles: Q2 - 7, Q3 - 1, Q4 - 2 and edition with SJR without IF - 4), 3 are published in unreferenced editions, and 2 represent chapters from books / collective monographs. According to the attached reference, the number of citations of the scientific publications submitted for participation in the competition is 131. The total IF of the scientific papers submitted for participation in the competition is 16,541. The results of the research activity were reported at 36 international and national scientific forums.

The enclosed documents show that Assistant Professor Silvena Boteva meets the minimum national requirements for occupying academic position "Associate Professor" (indicator A meets the minimum national requirements - 50, indicator B is 110 with a minimum value of national requirements - 100, indicator G is 249 at a minimum value of 200 and an indicator D is 196 at a minimum value of 50).

### **4. Scientific and research activity**

The scientific contributions of Assistant Professor Boteva are focused on four main areas:

#### **i. Influence of pollutants on soil microbial communities**

The functioning of the soil as a vital system and the maintenance of its biological productivity depends to a large extent on the activity of the soil microflora. Therefore, when assessing anthropogenic soil contamination, it is necessary to take into account changes in the size, composition and activity of soil microbial communities, variations in the loss of normal microbial species and the emergence of new ones compared to unpolluted soils. On the other hand, changes in soil microbial balance can serve as an "early warning" of negative transformations in the soil, long before they are detected by classical chemical methods and before they become irreversible. Therefore, comprehensive studies of soil microbiological activity are crucial for assessing the environmental risk of soil contamination. Part of the candidate's research work aimed at monitoring

the effect of various pollutants (fungicide azoxystrobin, radionuclides, heavy metals, petroleum products and methane) on the changes occurring in soil microbial communities is related exactly to this biologically important topic. These studies have been published in 10 scientific publications and presented at 13 national / international conferences.

An important contribution from the research work is the assessment of the impact of azoxystrobin on soil microbial communities. Assistant Professor Boteva showed that the effect of this fungicide depends on various factors, such as: soil type, applied dose and time of exposure, as the observed effects are different, but very often its use even in the lowest (recommended by the manufacturer) doses led to selection of aminoglycoside antibiotic-resistant bacterial species. She found that it stimulated resistance to streptomycin (sandy soils), ampicillin and chloramphenicol (sandy and loamy-sandy soils), with no effect on resistance to tetracycline (sandy and loamy-sandy soils) and streptomycin (loamy-sandy soils) where sensitivity was registered rather than resistance. An important contribution of the work of Assistant Professor Boteva is the establishment of the fact that the application of azoxystrobin for crop protection may be a possible way of transmission of antibiotic resistance to human microflora, and the exposure time is a crucial factor. The author found that even the lowest dose of azoxystrobin (close to the manufacturer's recommended) stimulated the emergence of bacterial antibiotic resistance in soils, and at concentrations higher than  $28.93 \text{ mg kg}^{-1}$ , especially in coarse-structured soils, this effect was irreversible.

Another important direction in the research of Assistant Professor Boteva was the monitoring of changes occurred in the enzyme activities of soil microbial communities under the influence of the fungicide azoxystrobin. Soil enzymes catalyze a large number of biological processes and provide a unique assessment of soil function, so studies on the effect of azoxystrobin on the activity of various soil enzymes are important from an ecological point of view allowing to characterize the level of soil pollution. The main contributions related to this scientific field are based on the study of the plasticity of various enzymatic activities (urease, beta-glucosidase, arylsulfatase, alkaline and acid phosphatases). After treatment of the soil with azoxystrobin a rapid change and slow recovery of the studied enzyme activities has been observed (incomplete even 4 months after the treatment). The applicant showed that this process can be affected at different rates by soil properties, residual concentrations of azoxystrobin and additives in the used fungicide. An analysis of the content of nitrogen and phosphorus in soils treated with azoxystrobin was also performed. It was found that under the influence of this fungicide an increase in the content of ammonium nitrogen and phosphates was registered, the concentration of nitrate nitrogen decreased and the acidity increased.

The research activity of Assistant Professor Boteva is also aimed at studying the effect of various radionuclides and heavy metals on soil microbial communities. Ore mining and processing are one of the most common human activities, worsening terrestrial ecosystems, causing physical disturbances and chemical / radiological contamination of soil and water. Therefore, the assessment of the impact of soil contamination with these compounds is of great importance globally due to the threats to the environment, food safety and human health. In her studies, Assistant Professor Boteva studied changes in the enzymatic activities (dehydrogenase, alkaline and acid phosphatase) of microbial communities isolated from sites contaminated with radionuclides and heavy metals, showing the ability of soil microorganisms to overcome toxic stress by increasing

dehydrogenase, alkaline and acid phosphatase activity, which in turn allows them to mediate the provision of vital ecosystem services, including participation in biochemical cycles, maintaining plant health and productivity, regulating carbon sequestration, etc. Interesting studies have also been carried out on the microbial profile of soils from abandoned uranium mines, showing a link between the level of pollution and the degree of microbial physiological diversity. Similar studies have been done in soils loaded with heavy metals, which showed that long-term soil contamination led to a reduction in soil microbial species diversity. Analyses on the toxicity of heavy metals in terms of microbial catabolic activity and functional diversity were of practical contribution, which showed that various aspects in the functional characteristics of microbial communities could be successfully used in assessing soil quality and environmental risk.

An important direction in the research of Assistant Professor Boteva were her studies on the processes of biodegradation of petrol and methane from natural microbial populations. As a result of these studies, a methanotrophic bacterial strain has been isolated which is capable of oxidizing methane at a wide range of concentrations and temperatures, that make it a potential agent for landfill bioremediation in order to reduce methane emissions.

#### **ii. Microflora of alpine lakes**

Another interesting area from an ecological point of view, in which Assistant Professor Boteva works, is the study of the microbial diversity in the alpine lakes. These harsh environments, which undergo relatively rapid changes in conditions such as water temperature, light, exposure to ultraviolet rays, and nutrient concentrations, are particularly interesting in terms of potential changes in the composition of bacterial communities. As a result of her research a number of important regularities have been established, three clone libraries of the analyzed samples from the "Okoto" lake have been constructed and changes in bacterial diversity have been registered in time and seasonal aspect. The obtained results are published in one scientific article and are presented at one national conference.

#### **iii. Ecotoxicology**

The research of Assistant Professor Boteva in the field of ecotoxicology is supported by 4 scientific publications and participation in 2 international forums. Some of them are focused on studying the impact of the herbicides paraquat and glyphosate on various vital indicators of cress salad (*Lepidium sativum* L.) and radishes (*Raphanus sativus* var. *radiculata* L.) and their possibility to be used as test objects for soil monitoring. In the same scientific field, the ecotoxicity of industrial wastewater on *Pseudorasbora parva* (ray-finned fish) and *Lepidium sativum* L (cress salad) was studied. The conducted research has several main important contributions, namely the outlining of innovative guidelines in the development of ecotoxicology and the use of new indicators to assess the risk and contamination level of ecosystems.

#### **iv. Use of remote methods in the field of ecology**

Assistant Professor Boteva also analyzed the applicability of two methods (based on pixels and based on objects) for classification of land cover and land use of satellite images. Through the use of geomorphometric techniques using a digital altitude model, she has proved the possibilities

of this approach for identifying a landscape unit for soil landscape, hydrological analyzes and studying the relationship between land cover and land formation processes. She has created a model for assessing the risk of erosion, determining the total levels of erosion and soil losses. Boteva has used a digital altitude model to determine the combined effect of environmental factors and human intervention on vegetation distribution. She has made a comparative analysis between two different systems for assessing the risk of forest fires - the Canadian system and the National System in the Mediterranean region - characterizing their effectiveness and adequacy. The conducted research in this field has been published in 5 scientific publications and has been presented at 5 international conferences.

The candidate's diverse interests are also seen in her other research related to "Ecology and Ecosystems` Protection", namely an assessment of the energy efficiency of various greenhouse crops; exploring the possibilities of using textile waste for the production of non-woven textile coatings for catching oil spills; analyzing the impact of the implementation of the Common Agricultural Policy in the Southwestern region of the Republic of Bulgaria. The data from the latest studies have been published in 3 scientific publications and have been presented at 5 scientific forums.

#### **5. Teaching-training activities**

The candidate for associate professor has significant teaching activity in both educational degrees - Bachelor's Degree and Master's Degree. The average annual auditorium is over 500 hours. She participates in the development and teaching of various compulsory and elective disciplines.

##### **Educational-qualification degree "Bachelor"**

*Practicals* for full-time and part-time students from Bachelor's Degree Programmes in Ecology and Environmental Protection, Biology, Bio-management and Sustainable Development, Biotechnology, Molecular Biology, Biology and English, Biology and Chemistry, Geography and Biology and Agrobiotechnology in the disciplines "Ecology and Environmental Protection", "Soil Science", "Waste Management", "Environmental Monitoring", Summer Training Practice in Ecology.

*Lectures* for full-time and part-time students from Bachelor's Degree Programmes in Ecology and Environmental Protection, Bio-management and Sustainable Development and Agrobiotechnologies in the disciplines: "Environmental Monitoring", "Soil Science" and "Environmental Impact Assessment".

##### **Educational-qualification degree "Master"**

She is the author and participates in the training process in several Master degree programs of the Faculty of Biology – MSc Programme "Business and Bio entrepreneurship" with the elective course in "Alternative Sources of Energy" and in the MSc Programme "Ecology" with the compulsory course in "Ecology of Microorganisms" and with the elective course in "Mapping and evaluation of ecosystem services". Assistant Professor Boteva also took part in the training process of MSc Programme "Ecotourism" in the Faculty of Geology and Geography giving lectures on "Environmental Impact Assessment". She also teaches at the Sofia Technical University in the MSc Programme "Engineering Ecology" giving lectures and practicals in the compulsory discipline

"Procedures for environmental impact assessment and complex permits".

Assistant Professor Silvena Boteva actively participates in the training of master graduates. At the time of submitting the documents for the competition, she was the supervisor of 11 successfully graduated students.

**The active participation of Assistant Professor Silvena Boteva in the teaching of various disciplines in Bachelor's and Master's degrees both in the Faculty of Biology, and in other faculties of Sofia University "St. Kliment Ohridski ", and other Universities in Bulgaria, shows her serious and committed attitude to teaching and learning.**

## **6. Development of scientific / educational projects**

Evidence of active research activities and recognized professional skills in the field is the candidate's participation in 13 national / international educational and research projects, 7 of which are for the period of the competition "Associate Professor" (2013-2020), and in 3 of them Assistant Professor Boteva is a leader. The subject of these projects is directly related to research and teaching professional field of the candidate, which shows compliance with the main trends in the modern development of education, specifically the integration of scientific knowledge in the learning process.

Her development as a qualified specialists in the field of "Ecology and Ecosystem Protection" is further confirmed by her participation alone or as a member of several teams, responsible for preparing more than 20 environmental assessments, designed for both private and public organizations.

## **7. Administrative involvement**

Assistant Professor Silvena Boteva is actively present as a member of the academic community with different administrative engagements: Secretary of the MSc Degree Programme "Ecology and Protection of the Environment", member of the Council of specialties in Agrobiotechnologies at the Faculty of Biology, etc.

## **8. Summary assessment**

The scoring of the scientific works with which the candidate participates in the competition is:

- ✓ Indicators from group A: PhD – **50 points**
- ✓ Indicators from group B: Habilitation – **110 points**
- ✓ Indicators from group G: Scientific publications – 219 points and 2 co-authored book chapters – 2 x 15 points = 30 points. Total: **249 points**
- ✓ Indicators from group D: Citations – **196 points**

**Total for all indicators: 605 points**

*(minimum requirements: 400 points)*

### **Critical remarks and recommendations**

I have no critical remarks or recommendations on the documents submitted by the candidate, as well as on her scientific and teaching activities.

### **CONCLUSION**

Based on the above analysis of the scientific achievements of Assistant Professor Silvena Boteva as a researcher and lecturer with an established research profile, it can be concluded that:

Assistant Professor Silvena Boteva is a well-established and recognized specialist in the field of Ecology and Environmental Protection, with proven contributions in the field of Ecology of microorganisms. In this field she has published over 30 scientific publications in leading international journals, which are cited more than 100 times in the world literature.

The reference on the fulfilment of the minimum national requirements shows that she has 605 points out of the required 400 minimum. These indicators exceed the official criteria of NACID for holding the academic position of "ASSOCIATE PROFESSOR" in the professional field 4.3. Biological sciences; scientific specialty "Ecology and protection of ecosystems" (Ecology of microorganisms).

In her professional career, she grew up in parallel as a researcher and university lecturer.

**All this gives me arguments to convincingly recommend to the esteemed scientific jury, as well as to the Scientific council of the Faculty of Biology at Sofia University "St. Kliment Ohridski" to award the academic position "ASSOCIATE PROFESSOR" to Assistant Professor Silvena Boteva Boteva.**

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The review is prepared by: .....

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