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Review

by Prof. DSc Neli Hristova Grozeva

Trakia University - Stara Zagora,

member of the Scientific Jury, appointed by Order No. 16/23.01.2024

of the director of IBER Assoc. prof. PhD Vladimir Vladimirov

REGARDING: Competition for the selection of an associate professor in the scientific specialty "Botany", professional direction 4.3. Biological Sciences, for the needs of the "Plant Diversity and Local Development" research group, "Applied Botany" section under the "Plant and Fungal Diversity and Resources" section, IBER-BAS, announced in no. No. 98/24.11.2023 of the State Gazette

Only one candidate submitted documents for participation in the competition - PhD Teodora Angelova Ivanova, chief assistant in the "Applied Botany" section, Institute of Biodiversity and Ecosystem Research, BAS. The presented materials are in accordance with the requirements of the Law on the Development of the Academic Staff in the Republic of Bu the Regulations for the terms and conditions for acquiring scientific degrees and for occupying academic positions at IBEI - BAS.

1. Career and thematic development

The candidate in the competition, chief assistant, Dr. Teodora Ivanova, completed her secondary education at the Science and Mathematics High School - the city of Haskovo, Biology profile with intensive study of the German language. In 1999, he obtained a bachelor's degree in biotechnology, and in 2003 a master's degree in plant biotechnology at the Faculty of Biology of the Sofia University "St. Kliment Ohridski". From 2003 to 2006, he worked as a specialist biologist at the Institute of Botany - BAS, Applied Botany section. For the period 2007-2010, he was a PhD student at IBER, BAS, developing a dissertation on the topic "In vitro cultivation of *Ruscus aculeatus* L. and *Ruscus hypoglossum* L. (Liliaceae)" and obtained the "doctor". In 2009, he received an award named after Prof. E. Palamarev" for young researchers. In the period 2010-2013, Teodora Ivanova worked as an "assistant" in the "Applied Botany" section, IBER-BAS, and from 2014 to the present moment she is the chief assistant in the same institute. Her main

scientific interests are related to ethnobotanical studies, conservation and valorization of plant diversity and related local knowledge, plant biotechnologies, phytochemistry.

2. Main scientific areas and scientific contributions of the candidate

Teodora Ivanova participated in the competition for associate professor with 26 scientific publications. The candidate has presented his publications according to a group of indicators, in accordance with the requirements for acquiring the academic position "associate professor" according to the announced competition. **The habilitation work** of Dr. Teodora Ivanova includes 6 publications, including 3 articles in journals with Q1, 1-Q2, 1-Q3 and 1 without SJR and IF, of which he is the lead author. **Outside the habilitation thesis**, the candidate presents 20 publications, in 5 of which he is the lead author, including 5 journal articles with Q1, 2-Q2, 3-Q3, 2-Q4 , 1 with IF, 4 book chapters and 3 articles without SJR and IF

The results of ethnobotanical research are presented in 19 co-authored publications. The candidate has distributed his scientific contributions in the field of ethnobotany in three main directions: plant diversity in Bulgarian song folklore; plant diversity of home gardens; (bio)cultural aspects/dimensions of plants - identity and valorisation, sustainable development and socio-economic aspects - ecological agriculture, food production and nutrition. I accept those indicated by Teodora Ivanova, main directions in her ethnobotanical studies.

A significant contribution of the candidate from the ethnobotanical research of Bulgarian folklore was the creation of an ethnobotanical database of 10,113 Bulgarian folk songs, collected since the 19th century from the entire territory of Bulgaria and among the historical diaspora abroad (in the Balkans and within Ukraine and Moldova) by defining the most important plants for a Bulgarian in the different types of songs (ritual, ballads, haidushki, historical, love, etc.). 4788 Bulgarian phytonyms (plants and their products) have been documented, assigned to 146 plant taxa belonging to 109 genera. It has been established that Bulgarian folk songs can be used as an indicator to evaluate the cultural ecosystem services of species and habitats, as well as be included in educational and informational materials to increase ecological culture. Based on an analysis of the plants mentioned in the Bulgarian song folklore, it has been proven that it reflects the cultural significance of plant diversity before the 17th century. I accept these contributions as original.

Regarding the applicant's research on the plant diversity of home gardens in rural areas of Bulgaria, it is striking that the study was carried out in over 60 settlements for the period from

2015 to 2023 and is the first multidisciplinary study to analyze the influence of socioeconomic, political and cultural changes on plant diversity in gardens. A significant contribution is the analysis of citizens' attitudes towards the protection and conservation of plant bioresources of wild and cultivated species within the yard gardens and food gardens cultivated by them near populated areas, and the collected new data on the use of 235 taxa of cultivated and wild growing plants, which have a variety of purposes - food (42%), decorative (44%), medicinal (4%), spices (9%), fodder (1%), technical (1%) and insecticidal (1%). I accept these contributions as original.

A significant contribution of the candidate is the country's first study of the influence of the variety of ways of use on the recognition of plant species, which is part of a study of the so-called gaps in knowledge, using *Ocimum basilicum* for this purpose. I accept the contribution as original. The preservation of traditional knowledge and the use of plants for symbolic and decorative purposes helps to better recognize species and contributes to better awareness and engagement with biodiversity conservation issues.

An original contribution is also the study of the representatives of the Lamiaceae family in gardens and the documentation of 27 of its representatives, which are most often used as medicinal and aromatic plants, but are also valued for their decorative qualities. It has been found that gardens can be seen as refugia for local forms of agrobiodiversity, as they grow a range of plants passed down through generations. For example, of the documented members of the Lamiaceae, over 80% are used as spices, which is the main motivation for their preservation. The introduction from nature is characteristic of the medicinal plants of the family, and the decorative ones are mainly procured from the commercial network.

The reasons affecting the biodiversity in the garden have been identified e.g. when the garden is the main source of sustenance for the household, the variety of species decreases, with edible plants predominating, including field crops that are not available or difficult to find on the market, offered by Bulgarian producers. The main factors and threats to the conservation of inherited indigenous plant genetic resources are identified. I accept these contributions as original.

Research on the (bio)cultural aspects/dimensions of plants - identity and valorization and sustainable development and socio-economic aspects are the subject of research in 15 of the candidate's scientific works. An original contribution is the study of several culturally significant species and their products, which are part of the identity of the communities that support them -

the samardala from Starozagorsko and the Sliven Balkans, the pink tomato from Kurtovo Konare, the Smilyan bean in the settlements along the upper course of the river .Arda and the cultural aspects of their production. Based on the analysis, it was concluded that the cultivation of these crops and the production of products from them require considerable manual labor, and adherence to traditional production technologies and compliance with specific recipes is a challenge that largely hinders entrepreneurship and complicates the maintenance of the quality of such products and the provision of services related to them.

The use of plant ingredients in 24 traditional meat products has been studied, and the use of 16 plant species, some of which are wild, has been documented. It has been proven that during industrial production, the variety of plant ingredients used decreases, which deprives the products of their taste and regional specificity and affects their popularity and demand.

The use of a significant variety of wild species (41 taxa) for making baked goods (so-called cabbages) has been documented, eleven of them being reported for the first time as food plants for Bulgaria, and *Centhaurea cyanus* L., *Erodium cicutarium* (L.) L'Hér, and *Geranium lucidum* L. are newly established in an international context. I accept this contribution as original.

An overview of the content of biologically active substances and toxic compounds in ruderal species, traditionally used for food by local communities in Bulgaria, was made and the possible health benefits and risks of the consumption of 65 taxa were assessed, as well as the possibilities for expanding food diversity and food security. I accept this contribution as original.

A method was adapted to study DM affiliation and the relationship of nutrition with quality of life, which was validated in 7 countries in Southern and South-Eastern Europe. The consumption of plant foods, incl. of nuts and legumes, of animal protein and lactic acid products. The obtained data show significant differences with the way of eating of Bulgarians in the beginning and middle of the 20th century in the direction of stimulating obesity and the development of cardiovascular diseases in modern living conditions. This is also reflected in the significantly lower results in the self-assessment of the quality of life and satisfaction with personal fulfillment compared to other European countries. I accept these contributions as original.

The candidate has grouped the remaining 7 scientific papers, apart from the 19 indicated in the field of ethnobotany, in 3 main areas: content of biologically active substances and biological activity of extracts of plant origin, biotechnological methods for propagation of economically

important and conservationally significant plants, taxonomic studies. I accept the indicated main directions.

The antiviral activity of extracts of Melissa officinalis against the causative agent of Awesky's disease - pseudorabies virus (SHV-1) in MDBK cell line and rabbit kidney cell culture (RK-8) was determined, and it was proved that the aqueous extracts had no cytopathic effect and prevented infection when administered together with the virus. I accept the contribution as original.

The antioxidant activity of *Melissa officinalis* extracts on lipid peroxidation (natural and induced) in mouse liver homogenate was determined, and the effectiveness of aqueous extracts was demonstrated. I accept the contribution as original.

The levels of total phenols, flavonoids and anthocyanins were determined and the antioxidant activity was determined by the DPPH and FRAP methods in fruits of seven Bulgarian cherry varieties (developed 1955-2017), with the potential to expand plantations of resistant varieties in the conditions of climate change. I accept the contribution as original.

The levels of phenols and flavonoids in *Allium siculum* subsp. *dioscoridis* (Sm.) K. Richt (samardala) from different origins (wild and domesticated) and the influence of different types of processing was analyzed. It has been proven that the modernized methods of processing preserve a greater part of the biologically active substances, compared to the traditional technology. I accept the contribution as original.

The research on the dynamics of saponin accumulation in cultures of *Ruscus aculeatus* and *R. hypoglossum* from Bulgarian origins and the possibilities for ex-situ conservation of both species is an original contribution. Appropriate nutrient media and combinations of 10 growth regulators were determined for the production of saponins and for long-term storage of clones with known biosynthetic profiles.

A significant contribution is also the research into the possibilities of cultivating psamophytes from the Bulgarian Black Sea coast with the aim of reintroduction. Seed germination was determined and in vitro cultures of 14 species were initiated.

The isoenzyme profiles and genetic affiliation of four morphologically close species of the *Festuca* - *F. valesiaca, F. rupicola, F. dalmatica* and *F. stojanovii* - were evaluated. I accept the contribution as original.

3. Significance of the obtained results

Eight of the presented total of 26 scientific papers by Teodora Ivanova were published in Plants, Nutrients, Diversity, Agronomy - scientific journals with the highest quartile (Q1), and another three articles were in publications with Q2. This is an indisputable guarantee of the quality of the publications, international recognition and comparability of the scientific research carried out by the candidate.

4. Most significant scientific and applied achievements

The ethnobotanical studies of T. Ivanova directly contribute to the assessment of cultural and provisioning ecosystem services provided by home gardens. Agrobiodiversity inventories and studies related to the use and attitudes of the society towards plant-based foods could be useful in the development of plans and strategies for ex situ and on farm conservation of plant resources, as well as for increasing public interest in environmental issues and the implementation of sustainable approaches in agriculture. This also corresponds to the applicants previous research in the field of plant biotechnology aimed at propagation of endangered medicinal plants.

5. Demonstrated skills or aptitude for leading scientific research

Teodora Ivanova is the lead author and corresponding author of 11 of the total of 26 scientific works presented in the competition. This fact proves her work and team management skills in the preparation of scientific papers.

Her participation in a total of 11 scientific projects over the entire period of her scientific career also shows teamwork skills, which is one of the most important for any researcher.

Based on my personal impressions of project implementation and participation in international and national forums in the last five years, T. Ivanova has at least 20 participations with oral reports and posters for the promotion of the results of the NSP Healthy foods for a strong bioeconomy and quality of life, NSP Environmental protection and risk reduction from adverse events and natural disasters; and Traditional food practices - basis for food market diversification and social innovation in rural areas; (FSR, KP-06-N66/11/15.12.2022).

6. Profile of the candidate's research work

The candidate's profile is clearly outlined by the subject of his scientific works, which are in the field of the specialty "botany" with a focus on biocultural diversity (ethnobotany and cultural anthropology) and the transformation of traditional knowledge about plants preserved in

Bulgarian society. Teodora Ivanova obtained PhD in the specialty "botany" and successively held the academic positions of "assistant" and "chief assistant" in the specialty "botany".

7. Role of the candidate for the training of young scientific personnel

Teodora Ivanova has participated in the development of educational materials for children and conducting informal training activities during the ethnobotanical surveys (seminars and focus groups) and during the implementation of the projects activities on inventory of food biodiversity and raising public awareness on topics related to the conservation of plant diversity and climate change: IPA CSO grant Environmentally Sustainable Socio-Economic Development of Rural Areas (2012-2016-ESSEDRA EuropeAid/132438/C/ACT/Multi Contract 2012/ 307-143 and n 2014/351-624) и AC55/2019 Eco-society through food: personal choices against climate change" (Active Citizens, EEAGrants).

8. Conclusion

The scientific indicators of chief assistant professor Teodora Ivanova, PhD, fully cover and exceed the minimum national requirements and the minimum scientometric requirements of the BAS for acquiring the academic position "associate professor". Based on the analysis of the scientific and scientific-applied activity of the candidate, I confidently declare my positive assessment and allow myself to suggest to the respected members of the Scientific Jury to also vote positively for the occupation of the academic position "**associate professor**" of chief assistant **Teodora Angelova Ivanova**, Ph.D. in the scientific specialty "Botany", for the needs of the research group "Plant diversity and local development", section "Applied Botany" under the section "Plant and mushroom diversity and resources", IBER-BAS.

03/20/2024 Reviewer:

Stara Zagora Prof. DSc Neli Grozeva