REVIEW

by: Prof. Dr. Anelia Evgenieva Kenarova, Faculty of Biology, Sofia University "St. Kliment Ohridski", member of the Scientific Jury, appointed by order RD-38-304/10.06.2024 of the Rector of Sofia University "St. Kliment Ohridski", Prof. Dr. Georgi Valchev

REGARDING: the materials submitted for participation in the competition for the academic position of "Associate Professor" at Sofia University "St. Kliment Ohridski" in the field of higher education 4. Natural Sciences, Mathematics, and Informatics; professional direction 4.3. Biological Sciences, Plant Physiology - Symbiotic Relationships in Plants

1. General Presentation of the Procedure

The competition for the academic position of "Associate Professor" in the field of higher education 4. Natural Sciences, Mathematics, and Informatics, professional direction 4.3 Biological Sciences, Plant Physiology - Symbiotic Relationships in Plants, was announced to meet the needs of the Department of Plant Physiology at the Faculty of Biology, Sofia University "St. Kliment Ohridski" in the State Gazette issue 32 from April 9, 2024.

Within the legally regulated period, the only candidate who submitted documents for this competition is Chief Assistant Dr. Marieta Georgieva Hristozkova.

All members of the scientific jury have declared that they meet the requirements of Article 4 of the Act for the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), have no joint scientific production or conflict of interest with the candidate in the competition, and fulfill the minimum national requirements under Article 2b, paragraphs 2 and 3 of the same act.

The submitted materials, available online on the website of the Faculty of Biology at Sofia University (https://www.biofac-unisofia.com/index.php/s/wozifsJSZjZ5tJS), comply with the requirements of the Act for the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), the regulations for the implementation of ZRASRB, and the regulations for the conditions and procedures for acquiring academic degrees and occupying academic positions at Sofia University "St. Kliment Ohridski" for the academic position of "Associate Professor" in the professional field 4.3. Biological Sciences.

The submitted documentation related to the competition is clearly and correctly structured. It reflects the candidate's educational, pedagogical, scientific, applied scientific, and administrative activities in qualitative and quantitative terms.

2. Overall Presentation of the Candidate

2.1. Brief Biography

Chief Assistant Dr. Marieta Hristozkova is an alumna of Sofia University "St. Kliment Ohridski," Faculty of Biology, where she graduated in 2002 with a Master's degree in Molecular Biology, specializing in Plant Physiology. She defended her doctoral dissertation in 2008 at the Institute of Plant Physiology and Genetics (Bulgarian Academy of Sciences), in the section of Mineral Nutrition and Water Regime. Her dissertation, titled "Influence of Molybdenum Deficiency on Nitrogen Assimilation in Nitrogen-Fixing Plants Pea and Alfalfa. Study of the General Stress Response in *Sinorhizobium meliloti* under Nitrogen and Carbon Starvation Conditions," was supervised by Prof. Dr. Ira Stancheva.

She began her professional career in 2002 in the section of Mineral Nutrition and Water Regime at the Institute of Plant Physiology and Genetics (Bulgarian Academy of Sciences) as a biologist specialist until 2008. From 2008 to 2018, she continued working in the same section as a Chief Assistant. Since November 2018, Dr. Hristozkova has been working as a Chief Assistant in the Department of Plant Physiology at the Faculty of Biology, Sofia University "St. Kliment Ohridski."

Chief Assistant Hristozkova has undertaken several important professional development specializations abroad:

- In 2005, at the Laboratory of Plant and Microbial Interactions (LIPM) affiliated with UMR INRA/CNRS, Toulouse, France, and
- In 2008, at the University of Göttingen, Department of Plant Nutrition, Georg August University, Göttingen, Germany

2.2. Overall Scientific Output and Scientific Activities

Dr. Hristozkova's overall scientific output includes 35 publications in peer-reviewed and indexed journals (33 articles), book chapters (1), and conference proceedings (1). Among them, 18 have Impact Factor (IF) and 27 have SJR (SCImago Journal Rank). The total Impact Factor is 25.817, and the total SJR is 11.718.

The citations from Scopus/Web of Science are 256. Dr. Hristozkova has presented her scientific results at 19 scientific conferences. She has served as a guest editor for the special issues "Arbuscular Mycorrhiza in Cropping System" in 2024 and "Arbuscular Mycorrhiza and Its Influence on Crop Production" in 2022 in the journal Agriculture (MDPI), and for the special issue "Research on Mycorrhizal Fungi" in 2023 in the journal Microorganisms (MDPI). She is also a member of the editorial board of the journal "Genetics and Plant Physiology."

Chief Assistant Hristozkova has reviewed 4 manuscripts for international scientific publications and 10 diploma theses completed at the Department of Plant Physiology.

She has participated in seven scientific projects, two of which are international. She has also been involved in activities to popularize science and present the Department of Plant Physiology (BioFest 2019, 2023; International "Fascination of Plants Day" 2019, 2022).

Hristozkova is involved in scientific networks under the COST Action CA 19116 “Trace metal metabolism in plants - PLANTMETALS” (2020-2024) and Action CA 22142 “Beneficial root-associated microorganisms for sustainable agriculture (ROOT-BENEFIT)” (2023-2027).

2.3. Evaluation of Teaching and Pedagogical Activities

Chief Assistant Hristozkova's teaching and pedagogical activities at the Faculty of Biology at Sofia University cover educational qualifications for the degrees of "Bachelor" and "Master". On average, the total and classroom teaching workload over the last 5 years has been 633.86 and 411.6 hours respectively—significantly exceeding the required minimum workload of 360 and 270 hours. She develops and delivers the lecture course "Plant Physiology" (specialty BMUR, 45 hours), the lecture and practical course "Superfoods of Plant Origin" (specialties MB, BiA, BiH, BiG, 30 hours of lectures and 15 hours of exercises), and electronic educational resources on "Plant Physiology" (specialties MB, Biology, EOOOS, BiH, BiA, BiG, BMUR, and BT).

Chief Assistant Hristozkova supervises the summer educational practice for students majoring in Molecular Biology, participating in its implementation with two practical exercises.

She is the academic advisor for three successfully defended final theses, 17 term papers, and mentors five research circle participants in the Molecular Biology program.

2.4. Evaluation of the Candidate's Administrative Engagement

Chief Assistant Hristozkova has been the secretary for educational and scientific activities at the Department of Plant Physiology (2019 – present). She is also the secretary of the Master's program in Plant Physiology (2019 – present). She has participated in candidate student campaigns as a scrutineer and examiner (2019 – 2022) and in committees for grading written exams for state exams (2019 – 2023) in the Molecular Biology program.

3. Evaluation of Compliance with Minimum National Requirements

The report on meeting the minimum national requirements under Article 2b of the Act for the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB) for scientific field 4. Natural Sciences, Mathematics, and Informatics; professional direction 4.3 Biological Sciences demonstrates quantitative indicators that fully meet these criteria, as follows:

- **Indicators from Group A**: Dissertation work for the award of the educational and scientific degree "Doctor": Influence of molybdenum deficiency on nitrogen assimilation in nitrogen-fixing plants pea and alfalfa. Study of the general stress response in *Sinorhizobium meliloti* under nitrogen and carbon starvation conditions. Scientific

specialty: Plant Physiology, code 01.06.16, 2008. Diploma No. 32425 /09.06.2008, VAK, protocol 03, No. 06/08.

Dissertation work - 50 points.

- **Indicators from Group B**: B4 Habilitation work - scientific publications in journals indexed and abstracted in globally recognized databases with scientific information (Web of Science or Scopus).

  For the fulfillment of this indicator, the following are specified:

  Q1 - 3 articles (Nos. 7, 9, and 15 from 10B.SelectedPublications)

  Q2 - 2 articles (Nos. 1 and 2 from 10B.SelectedPublications).

  Total for indicator B - 115 points (minimum requirement 100 points).

- **Indicators from Group G**:
  - **G7** Scientific publications in journals indexed and abstracted in globally recognized databases with scientific information (Web of Science or Scopus). Among them:
    - Q1 – 1 article (No. 19 from 10B.SelectedPublications)
    - Q2 – 6 articles (Nos. 10, 11, 13, 18, 21, and 26 from 10B.SelectedPublications)
    - Q3 – 6 articles (Nos. 5, 6, 12, 14, 16, and 23 from 10B.SelectedPublications)
    - Q4 – 4 articles (Nos. 3, 4, 8, and 25 from 10B.SelectedPublications)

Note: Publication 24 is not counted as its content is fully included in publication 21; publication 27 is not counted as it was considered during the defense of the dissertation in NACID.

  - **C8** Published book chapter or collective monograph - 1 item (No. 20 from 10B.SelectedPublications)

    Total for indicator G - 298 points (minimum requirement 200 points).

- **Indicators from Group D**:

  D11 Citations in scientific journals, monographs, collective volumes, and patents, indexed and abstracted in globally recognized databases with scientific information (Web of Science and Scopus). **256 citations in Scopus**/Web of Science.

  Total - 512 points (minimum requirement 50 points)

Conclusion on point 3: The candidate fully meets the criteria of the Act for the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB) and its implementing regulations for the position of "Associate Professor". Regarding indicators G and D, the candidate significantly exceeds the regulatory requirements.

4. Scientific, Scientific-Applied, and Methodological Contributions of the Candidate

The scientific activity of Assoc. Prof. Hristozkova has developed in several closely related areas related to the formation of beneficial symbiotic relationships with microorganisms in plants

and the benefits of these symbioses for overcoming abiotic stress, as well as opportunities for enhancing plant tolerance following in vitro propagation.

Note: In the submitted materials, Assoc. Prof. Hristozkova has indicated her scientific contributions based on 35 scientific publications (book chapter) from file 10A.AllPublicationsList. The review includes contributions from scientific developments (26 in total) submitted for the competition (file 10B.SelectedPublicationList). Despite the partial reduction in peer-reviewed scientific works, the evaluation of Assoc. Prof. Hristozkova's contributions is very high, as her contributions are not only of high scientific value but also have high practical significance.

Contributions with scientific and scientific-applied value

1. Beneficial Plant-Microorganism Relationships

1.1. Influence of the plant-mycorrhizal fungi symbiosis on plant individuals

Several publications by Assoc. Prof. Hristozkova investigate symbiotic relationships [1, 2, 6, 7, 9-15, 18, 22] between various plant species ((*Physalis peruviana* L., *Ocimum* spp., *Thymus vulgaris* L., *Vigna unguiculata* (L.) Walp, *Origanum majorana* L., *Physalis peruviana*, *Lactuca* spp., *Calendula officinalis* L., *Sideritis scardica* Griseb.)) and symbiotic mycorrhizal fungi (*Claroideoglomus claroideum*, *Glomus intraradices*, *Rhizophagus clarum*, and *Funneliformis mosseae*). The contributions of these developments are as follows:

- Clearly reported trend of improved drought tolerance and resistance to heavy metals in plant individuals under established symbiosis [1, 2, 11, 12, 13];
- Demonstrated enhancement in growth parameters, fertility, as well as the content of plastid pigments, antioxidant activity, activity of enzymes involved in biogenic element transformation [1, 2, 7, 9, 11, 12, 13, 22], gas exchange [6, 9, 10], among others, in plant individuals;
- Established the influence of the spectrum of sunlight on the efficiency of mycorrhizal symbiosis [9].
- Established improvement in the efficiency of mineral nutrition in plants when applying synthetic nitrogen fertilizers [14], as well as when combined with microalgae [6, 10];
- Identified reduction in the absorption of heavy metals and their accumulation in the usable parts of plants [12, 13, 18];
- Demonstrated enhancement in the quality of essential oils in *Origanum majorana* L. [18], alteration in the composition of fatty acids in *Physalis peruviana* L. [13], as well as changes in the carotenoid profile of *Calendula officinalis* [15];

1.2. Symbiotic relationships between leguminous plants and nitrogen-fixing bacteria

In a series of publications [11,17,19,20,23,25,26,28], Assistant Professor Christozkova demonstrates the significance of symbiotic nitrogen fixation for the development of leguminous

crops, as well as the methods for stimulating it when there is a deficiency of micro- and macro-elements in the soil. The contributions in this area are as follows:

- It has been established that the deficiency of Mo in the soil reduces the nitrogen-fixing activity of alfalfa and peas [20,26].
- Effective nitrogen-fixing symbiotic systems have been proven between *Vigna unguiculata* and the nitrogen-fixing bacterium *Bradyrhizobium japonicum* and the mycorrhizal fungus *Glomus intraradices* [11,17], as well as between *Medicago sativa* and *Sinorhizobium meliloti* [25].
- Nitrogen-fixing symbiotic systems in *Vigna unguiculata* with the nitrogen-fixing bacterium *Bradyrhizobium japonicum* and the mycorrhizal fungus *Glomus intraradices* improve the nutritional value of the fruits of *Vigna unguiculata* without being significantly affected by soil moisture [17].
- Proven improvement in the efficiency of nitrogen fixation under Mo deficiency through foliar fertilization [23,28].
- Proven increase in nitrogen-fixing activity in alfalfa nodules with an increase in CO2 content in the rhizosphere [19].

2. Influence of abiotic conditions, abiotic stress factors, and the form of reproduction (in vitro) on vegetation

The contributions in this field are:

- It has been established that the enzymatic antioxidant potential (*Origanum heracleoticum* L., *Hyssopus officinali*, *Thymus vulgaris* L., and *Sideritis scardica*) and the composition of essential oils (*Origanum heracleoticum* L. and *Hyssopus officinalis*) are influenced by environmental conditions [3,4,5,7,8,16] and the method of reproduction (natural or micropropagation) [3,4,5,7,8]. Micropropagation has a better effect on antioxidant potential.
- The negative impact of heavy metal soil contamination on biomass accumulation in *Salvia officinalis* L. has been established, without reducing the quality of the essential oils [21].

<u>Methodological Contributions</u>

A significant portion of Dr. Christozkova's scientific work also focuses on developing protocols for effective *in vitro* plant propagation and adapting them for transfer to natural environments [2,3,4,5,7,8]. This opens up new possibilities for the dissemination of plant species in their natural habitats, the cultivation of valuable medicinal plants for industrial purposes without exerting pressure on their natural populations, and the wider use of mycorrhizal symbiosis to increase the tolerance of cultivated plants to abiotic stress factors and improve their productivity.

5. Evaluation of the Candidate's Personal Contribution

A thorough review of the scientific works and accompanying documentation presented by Chief Assisstant Christozkova for participation in this competition gives me reason to conclude that the experimental arrangement, execution, analysis, interpretation, and publication of the presented scientific achievements are of significant personal contribution. I can summarize the achievements and activities of Chief Assisstant Christozkova as follows:

- Of the recognized 26 publications (10BSelectedPublicationsList), Assistant Professor Christozkova is the first author in 52%, the second author in 12%, and the third/fourth author in 24% of them, which collectively makes up about 88% of the entire scientific output proposed for evaluation in the competition;
- The total number of points for meeting the minimum national requirements is 965, with a minimum of 400 points according to the PPZRA, or 241% fulfillment;
- She participates in numerous scientific forums and events for the dissemination of knowledge and achievements in her field of work.
- An internationally recognized expert in the field of mycorrhizal symbiosis with expertise demonstrated as a guest editor of specialized editions, participation in the editorial board of a specialized scientific journal, and as a reviewer for scientific journals.
- Active work with students, both in the mandatory educational process (152% fulfillment of classroom activities and 176% of overall workload), as well as engagement with graduates, student groups, and various student initiatives.
- Participation in the administrative work of the department.

I am convinced that Chief Assisstant Marieta Hristozkova possesses all the professional qualities: scientific capacity, teaching skills, administrative approach, and collegiality required for the position of “associate professor”.

6. Critical Notes and Recommendations

To the scientific and teaching activities, I have no comments or recommendations. Regarding the presented materials and documentation, my remark is related to:

- The contributions are prepared based on the overall publication activity, not on the publications for the competition
- Inaccuracies in the citation reporting.

7. Conclusion

All formal requirements specified in the Law on the Development of Academic Staff in the Republic of Bulgaria, the Regulation for its Application, and the Regulation on the Conditions and Procedure for Obtaining Scientific Degrees and Occupying Academic Positions at Sofia University "St. Kliment Ohridski" have been met. Sufficient and compelling evidence has been

provided for high-quality scientific, applied scientific, and educational-pedagogical activities. Based on the analysis of this evidence, I am able to give a positive assessment of the candidacy and confidently recommend to the esteemed scientific jury appointed by Order RD-38-304/10.06.2024 of the Rector of Sofia University "St. Kliment Ohridski" to prepare a report-proposal to the Faculty Council of the Faculty of Biology at Sofia University "St. Kliment Ohridski" for the appointment of Chief Assisstant Dr. MARIETA GEORGIEVA HRISTOZKOVA to the academic position of "associate professor" in the field of higher education 4. Natural Sciences, Mathematics and Informatics; professional field 4.3. Biological Sciences, Plant Physiology - symbiotic relationships in plants.

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