

STATEMENT

By Assoc. Prof. Dr. Silvena Boteva Boteva, PhD, Department of Ecology and Environmental Protection, Faculty of Biology, Sofia University "St. Kliment Ohridski", member of the jury by Ordinance № ПД-38-473/24.07.2024

Subject: dissertation of Gloria Biserova Georgieva, for obtaining educational and scientific degree of “Philosophy Doctor” in the field of 4.3. Biological Sciences (Microbiology) at the Department of General and Industrial Microbiology, Faculty of Biology, Sofia University "St. Kliment Ohridski", with scientific supervisor Assoc. Prof. Dr. Trayana Nedeva, PhD and scientific consultant Prof. Dr. Petya Hristova, PhD

Biographical data about the PhD student:

Gloria Biserova Georgieva graduated with a Bachelor's degree in Biotechnology from the Faculty of Biology of Sofia University in 2019 and a Master's degree in Industrial Biotechnology in 2021. She is enrolled as a full-time PhD student at the Department of General and Industrial Microbiology of the Faculty of Biology, with order № ПД -20-1254/01.07.2021, with dissertation topic "Physiological and biochemical characteristics of the plant - microbial symbiosis of representatives of the genus *Pseudomonas*" with scientific supervisor Assoc. Prof. Dr. Trayana Nedeva. During the PhD the required number of exams were passed and the necessary credits were acquired according to the individual plan of the PhD student. All the deadlines and criteria according to the Regulations on the conditions and procedure for the acquisition of scientific degrees and academic positions at the Sofia University, as well as the minimum national requirements according to the Act on Academic Degrees and Academic Positions were met.

Data on the dissertation thesis: The content and volume of the dissertation meet the requirements for this type of scientific work.

Topic: The topic of the dissertation " Physiological and biochemical characteristics of the plant - microbial symbiosis of representatives of the genus *Pseudomonas*" reflects its content correctly. A number of analyses have been carried out to study plant-microbe symbiosis and accumulate evidence of prominent characteristics of selected strains of the genus *Pseudomonas*, such as *Pseudomonas chlororaphis* 1S4 and *Pseudomonas yamanorum* 1046 for plant growth promotion.

Main parts of the thesis: The **literature review** is comprehensive and well structured, covering 45 pages, 6 figures and 1 table. It consists of 6 chapters in which: the role of rhizosphere microorganisms in stimulating plant growth, the plant growth-promoting abilities of *Pseudomonas chlororaphis* and *Pseudomonas yamanorum*, the nature of plant-microbe symbiosis, and the application of these microorganisms as biological control agents in agriculture are discussed.

The **aim** of the PhD thesis is the selection and study of bacterial strains belonging to the genus *Pseudomonas* to study the phenomenon of plant-microbe symbiosis and to prove their PGP-potential. Three **tasks** with a total of 8 sub-tasks were formulated, the completion of which covers the achievement of the set goal.

In the **Materials and methods** section, the methods used are described in detail, and the application of both culture and modern molecular methods is impressive. Not to be overlooked is the wide variety of methods learnt and applied, and in addition to the above mentioned, those for enzymatic activity, HPLC analysis for phytohormone quantification, and plant seed germination assays can be added. As a recommendation, the information for statistical programs and data processing methods used could be separated in a single part.

The **Results and Discussion** chapter covers 86 pages, with information richly supported by 57 figures and 9 tables.

My main comments and observations on this part of the paper are:

- - In places the Results and Discussion take on the character of the Materials and Methods section. For example, the description of the ApiZYM system could be moved to the methodology part of the thesis. The same applies to the information on the treatment options when conducting vascular plant experiments.
- - Figures cited in the text, such as Figure 45 and Figure 46, are missing.
- - I recommend citing the figures directly in parentheses instead of writing "...are shown in figures..." or "results are presented in Figure....".
- - Figures 47 and 48 are before the text, and it is nice to have them afterwards as support for what the PhD student has written.
- - The decimal point when writing numbers should be uniformed by choosing either a period or a comma.

Eight **conclusions** are formulated, summarizing the results of the individual tasks, four original **contributions** and one confirmatory contribution.

In **Appendix 1** the results of the genetic analysis of isolates belonging to *Pseudomonas sp.* and *Fusarium sp.* are given.

Cited literature: A total of 347 sources are cited, of which 343 in Latin and 4 in Cyrillic. This confirms the rich theoretical background of the PhD student. It should not be overlooked that most of the literature sources used are from recent years. My main remark on the literature cited is the absence of the journal name, volume, pages in many places (e.g. citations 322,325, 327, 330, 333, 334, etc.). Also, the journals that are referenced are cited in different ways, either abbreviated or in full. I recommend not to write a comma after the last name after listing the author collective.

Thesis abstract: The thesis abstract contains 60 pages and essentially reflects the content of the thesis. The parts included are Introduction, Aim, Objectives, Materials and Methods, Results and Discussion, Conclusions, Contributions, Publications, Participations in scientific forums, Noted citations. For two of the publications it is not indicated where they have been accepted for publication. The remaining comments and recommendations on the dissertation also concern the abstract.

Publication activity: The PhD student has submitted a list of three publications in periodicals on the topic of the dissertation - two articles with quartile Q4 and one with quartile Q3, which carry a total of 39 points. This exceeds the minimum number of 30 points for 4.3. Biological sciences, according to Annex 1 of the Act on Academic Degrees and Academic Positions. In all three papers the PhD student is first author, which proves the importance of her contribution to the research.

The scientific contribution of Gloria Georgieva is complemented by her participation in four scientific forums with posters and also by 2 citations of an article with her participation.

Conclusion: The dissertation submitted for my opinion deals with a contemporary but at the same time disturbing topic, which is the search for ways to achieve higher crop yields in order to tackle the food problem, which at the same time to be environmentally friendly. The results of the experiments carried out are promising and of practical relevance as a prerequisite for the use of the rhizosphere strains *Pseudomonas chlororaphis* 1S4 and *Pseudomonas yamanorum* 1046 as components of biological control preparations and as an environmentally friendly alternative to conventional fertilizers. The remarks and comments made are entirely constructive in nature and in no way detract from the value of this scientific work. The requirements for the award of the scientific and educational degree of Philosophy Doctor have been fulfilled and I give my **positive opinion** on the award of the scientific and educational degree of “Philosophy Doctor” to **Gloria Biserova Georgieva**.

21.09.2024
Sofia

Statement prepared by:
/Assoc. Prof. Dr. Silvena Boteva, PhD /