



## REVIEW

**of a dissertation thesis** for obtaining the educational and scientific degree "Doctor" in the field of higher education 6.0 "Agrarian Sciences and Veterinary Medicine", professional field 6.1. "Plant Growing", scientific specialty "Ornamental Plants"

### **Author of the dissertation thesis:**

Land. Arch. Mariya Petkova Grozeva, independent doctoral student at the Department of "Horticulture" at the Agricultural University, Plovdiv

**Topic of the dissertation thesis:** "Typology and Methods for Noise Protection Through the Use of Green Plantings in an Urban Environment."

**Reviewer:** Prof. Dr. Emil Nikolov Galev, Forestry University, field of higher education 6.0 "Agrarian Sciences and Veterinary Medicine", professional field 6.5. "Forestry", scientific specialty "Greening of Settlements and Landscapes", appointed as a member of the scientific jury by Order No. RD-16-776/23.06.2026 of the Rector of AU.

### **1. Brief Presentation of the Candidate**

The doctoral student Maria Petkova Grozeva was born in 1980 in the city of Ashgabat, Turkmenistan. In 1998, she graduated with honors from the "V. Levski" Secondary School in Stara Zagora with a profile in drawing, and in 2006 she graduated in "Landscape Architecture" at the Forestry University in Sofia, acquiring the professional qualification of "Master Landscape Architect".

From 2004 to 2008, she served as the Manager of the company "LANDSHAFT PROEKT" OOD, Sofia, which carries out design and consulting activities in the field of investment design. In the period from 11.2008 to 10.2017, she worked as an Expert in Green Systems and Recreation at the municipal enterprise "SOFPROEKT-OGP", Sofia, where she was engaged in the design and management of investment projects and programs. From 11.2017 to 06.2018, she was the Manager of "MG STUDIO" EOOD, Sofia, where she prepared landscape projects for parks, gardens, sports and playgrounds, etc. In the period from 06.2018 to 08.2021, she served as Deputy Mayor, Portfolios: Ecology, Education, Sports, Culture, and Social Activities in Mladost District, Sofia Municipality, where she organized and managed the processes in the entrusted portfolios, communicated with various departments and agencies, and prepared and monitored the implementation of annual projects and programs. From 08.2021 to the present, she is the Manager of the company "MG STUDIO" EOOD, Sofia, where she is engaged in the preparation of landscape projects for parks, gardens, sports and playgrounds, street greening, retail parks, etc.

Since 2017, she has been an independent doctoral student at the Department of "Horticulture" at the Faculty of Viticulture and Horticulture of the Agricultural University, Plovdiv. She was enrolled by Order No. RD-26-55/29.06.2017 and dismissed with the

right to defense by Order No. RD-16-560/30.04.2025 of the Rector of AU-Plovdiv. During her doctoral studies, she passed three doctoral exams with excellent results in 2018 and 2019.

Maria Grozeva's rich professional experience is firmly rooted in the foundation of the doctoral thesis presented by her. Her undeniable talent and creative pursuits in the field of landscape architecture are evident in the numerous projects she has prepared in the section "Park Development and Public Works" and her participation in national and international projects for the design of public spaces.

The doctoral student also has 2 publications and 3 participations in conferences related to her research interests and creative work. Her scientific works thoroughly investigate the problems related to силуета на дисертацията (the topic of the dissertation), and the conclusions drawn therein are the result of the experience gained in her overall work as a designer who seeks to apply her experience and knowledge in the field of landscape architecture through scientific research.

She is a member of the Chamber of Architects in Bulgaria (CAB) with full design legal capacity in the project section "Park Development and Public Works". She is also a member of the Union of Landscape Architects (ULA).

She possesses high computer literacy in word processing, digital data processing, and design, and is proficient in working with software in the fields of architecture and landscape architecture: AutoCAD, ArcView, CorelDraw, Photoshop, Microsoft Office, etc.

The briefly presented biography of the doctoral student unequivocally proves her capacity for self-discipline, organization, goal-orientation, and work ethic, which match my personal impressions as her teacher.

## **2. Relevance of the Problem**

The topic of the dissertation thesis is highly relevant at present, and its relevance will continue to increase even more in the future. In recent years, acoustic discomfort in urbanized areas has turned into a chronic stress factor and an "invisible enemy" that inflicts serious damage on the physical and mental health of the population, increasing the risk of cardiovascular diseases, cognitive deficits, and sleep disorders. Therefore, there is a continuously growing need to study the phytoacoustic potential of tree and shrub species in our country, to create highly effective green noise protection screens, as well as to derive methodological guidelines and statements, and develop models for their construction.

It is necessary to develop applicable noise protection methods in our country based on the experience of other countries around the world. In this regard, all landscape architects in Bulgaria need a comprehensive, scientifically validated applied toolkit that links the dendrological composition of vegetation and the spatial architectonics of plantings with specific quantitative calculations of the damping effect.

In support of the relevance of the problem in the dissertation, the conducted research, and the chosen methodologies, numerous literary sources are cited that logically follow the main research thesis of the dissertation.

### **3. Aim, Tasks, Hypotheses, and Research Methods**

The dissertation thesis aims to develop a scientifically based concept encompassing spatial-functional typological models and methodological guidelines for the construction of highly effective green noise protection screens, as well as to quantitatively express the phytoacoustic potential of a specific reference assortment of tree and shrub species under the real ecological conditions of the Sofia agglomeration. To achieve this goal, five specific tasks have been logically formulated and set in a clear sequence:

- Systematic and detailed analysis of the physical-biological mechanisms of propagation, absorption, and scattering of sound waves through plant masses.
- Conducting systematic instrumental monitoring *in situ* at selected control points along the main street network of the city of Sofia.
- Experimental determination and quantitative measurement of the impact of the seasonal factor (phenological phases of foliage and dormancy) on the isolation capacity of deciduous and coniferous belts.
- Performance of a multicriteria dendrological analysis and evaluation of the ecological plasticity and gas resistance of priority species under conditions of anthropogenic stress.
- Development of digital phytoacoustic models and creation of an original Constructive Typology of phytoscreens (Type 1, Type 2, and Type 3) for practical application.

The chosen sequence for studying the problem is related to the main factors of noise pollution in the urban environment as a whole and the limiting factors influencing the selection of vegetation for noise protection purposes.

The study is based on system analysis, which allows objects to be viewed as part of a system whose characteristics depend on the individual elements of the urban fabric, interconnected and influenced by external and internal anthropogenic factors of the territory.

To achieve the universality of the models, a comparative analysis of the studied objects was carried out. To reveal the core characteristics of the studied objects, structural analysis was used, the results of which serve as a basis for forming the spatial-functional typological models.

The chosen methods are fully appropriate for achieving the goals and fulfilling the tasks of the dissertation. The approach enables the construction of a general picture and the formulation of the scientific hypothesis that the acoustic efficiency of plant barriers is not a

simple linear function of the total biomass, but has a nonlinear relationship with the internal structural organization of the stand (tiering, density, micromorphology), its distance from the source, and seasonal phenological dynamics. In the process of research on the topic, the author demonstrates a high level of knowledge and an original flair for the meaningful combination of diverse research methodologies.

#### **4. Visualization and Presentation of the Obtained Results**

The presented dissertation thesis is structured into 6 chapters and contains 162 pages of text and 13 pages of references. For their better presentation, the research results are illustrated with 186 pages of text and tabular material, 43 drawings, 48 color slides, 41 graphic schemes and diagrams, and 63 photographs, placed in appendices contained in 120 computer files.

The appendices also contain the approbation of some noise protection methods using green plantings through project case studies with instrumental measurements for 6 specific sites located in urban environments with a high degree of noise pollution caused by vehicular traffic, construction, and public life.

#### **5. Discussion of Results and Literature Used**

The obtained results are presented in detail and fully correspond to the set goals. Their logical interpretation has enabled the doctoral student to formulate conclusions and recommendations that fully match the set tasks. The work undoubtedly proves the necessity of noise protection methods through the use of green plantings in an urban environment. The realism and applicability of these models are also proven through the conducted approbations. This was achieved through the author's interpretation of a large volume of studied literary sources and electronic websites. Unquestionably, the doctoral student's excellent command of computer techniques and foreign languages has aided her exploratory work.

A special place in the dissertation thesis is devoted to establishing and quantitatively measuring the impact of the seasonal factor (phenological phases of foliage and dormancy) on the insulation capacity of deciduous and coniferous belts. Of substantial importance are the developed digital phytoacoustic models, as well as the created original Constructive Typology of phytoscreens (Type 1, Type 2, and Type 3) for practical application.

For the development of the dissertation thesis, the author has conducted a thorough review of 34 literature sources on the problem in Cyrillic and 115 in Latin. She is excellently familiar with the state of the problem, allowing her to analyze the literature review thoroughly and accurately, as well as to interpret it creatively. Everywhere she has indicated her personal conclusions and opinions on the topics discussed.

She has also made a critical assessment of current practice in our country by tracing the chronology of the successful or unsuccessful real-life resolution of research questions from her work. Through the analysis and evaluation of selected specific study objects, she has

highlighted the opportunities, conditions, and limitations for constructing highly effective green noise protection screens. She has formulated valuable conclusions that she skillfully uses when developing noise protection methods using green plantings in urban environments.

The analysis of literature sources is made within the structure of Chapter One of the dissertation. The large number of sources used demonstrates the doctoral student's endeavor to study the various aspects of her thesis as thoroughly as possible by correctly selecting titles according to the objectives of the research topic.

Many of the cited publications are from recent years, demonstrating a high degree of awareness not only regarding the genesis and development of research work on the topic and global achievements, but also regarding the specifics of using and combining diverse research methods.

## **6. Contributions of the Dissertation Thesis**

I give an entirely positive evaluation of the dissertation thesis and find that it contains the necessary scientific-theoretical and scientific-applied contributions.

The main conclusions from the conducted research can be assessed as synthesized, logical, significant for science and practice, and summarizing the most important results obtained within the framework of the research related to the comprehensive study of noise protection screens.

Through the typology and methods for noise protection using green plantings in an urban environment developed within the research on the topic, it can be considered that the set goal of the research has been achieved.

The report on contributions reflects the most important achievements of the dissertation thesis. The comprehensive analysis of the doctoral student's scientific work is a necessary and sufficient condition for conclusions and assessments of a scientific-theoretical contribution character. Considering the relevance of the problem, the very large volume of research performed, the critical analysis of the obtained results and their correct interpretation, and the formulated conclusions and contributions of the work, I consider the following to be самый значими (the most significant):

### **Scientific-Theoretical Contributions**

- **Defined the physical-biological mechanism of noise absorption by tree and shrub vegetation:** It has been scientifically proven that phytoscreens function as a complex system for sound energy dissipation through a synergy of absorption, diffraction, and microreverberation.
- **Proven seasonal (phenological) dynamics of the noise-absorbing capacity of tree and shrub vegetation:** The "phenological collapse" in acoustic efficiency

among fully deciduous masses during the winter period has been quantitatively measured and proven.

- **Developed a mathematical model of acoustic transfer in an urban environment:** A model for the quantitative calculation of insertion loss (*Insertion Loss*) has been created.

### **Scientific-Applied Contributions**

As scientific-applied contributions that enrich existing knowledge with new research and formulations, the following can undoubtedly be recognized:

- **Creation of an original Constructive Typology:** Three spatial-functional models of phytoscreens (Type 1: Aerodynamic, Type 2: Checkerboard, Type 3: Combined) have been developed and validated.
- **Construction of a Complex Selection Matrix:** A specialized matrix for selecting priority tree and shrub species for Zone 6 has been developed.
- **Approbation in a real urban environment:** The technical-economic and landscape efficiency of biological solutions for critical infrastructure sites (Technopolis Shopping Complex, Botevgrad Residential Complex) has been proven.

The contributions are of an original character and high significance for science and practice, not only regionally. Accepting the contributions of the work, I believe that the set goal of the study has been achieved.

The doctoral candidate's personal participation in the contributions is evident and significant. The research shows that she participated most actively in creating the typology and methods for noise protection using green plantings in an urban environment, as well as in their approbation.

The work on the dissertation thesis and its results represent an exclusively personal contribution by the doctoral candidate, which adds even greater weight to the stated scientific-theoretical and scientific-applied contributions.

### **7. Critical Remarks and Questions**

I have no critical remarks that would be essential for determining my conclusion in this review.

### **8. Published Articles and Citations**

On the topic of the dissertation thesis, the doctoral student has made 2 publications in a modern Bulgarian scientific journal, referenced and indexed in world-renowned scientific information databases, namely:

1. Grozeva, M. P. (2023). An Optimised Design for Transport Noise Pollution Reduction in the Children's Area and Recreation Spots. *Agricultural Sciences*, 15(37), 12-19. DOI: 10.22620/agrisci.2023.37.002
2. Grozeva, M. P. (2023). Macedonia Boulevard Linear Park Design for Reduced Transport Noise Pollution. *Agricultural Sciences*, 15(37), 20-29. DOI: 10.22620/agrisci.2023.37.003

Parts of the dissertation thesis have been presented in the form of reports, posters, and presentations on the topic at three scientific conferences with international participation.

I believe that in this way, the most essential and significant parts of the research conducted on the topic of the dissertation thesis have been maximized in popularity and made sufficiently visible to the scientific community. I sincerely hope these developments will find resonance in the academic community. My personal assessment of this point of the review is entirely positive.

The presented abstract objectively reflects the structure and content of the dissertation thesis.

#### **CONCLUSION:**

The above gives me grounds to assert that the dissertation thesis is a study of a significant and current scientific problem, featuring scientific-theoretical and scientific-applied contributions that enrich scientific knowledge and support practice.

Based on the various research methods learned and applied by the doctoral candidate, the correctly conducted experiments and analyses, and the generalizations and conclusions drawn, I consider that the presented dissertation thesis meets the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB) and the Regulations of the Agricultural University for its application, which gives me grounds to evaluate it **POSITIVELY**.

I take the liberty of proposing that the esteemed members of the Scientific Jury also vote positively for awarding land. arch. Maria Petkova Grozeva the educational and scientific degree "Doctor" in the scientific specialty "Ornamental Plants" from professional field 6.1. "Plant Growing", in the field of higher education 6.0 "Agrarian Sciences and Veterinary Medicine".

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city of Plovdiv

REVIEWER

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