



REVIEW

on the dissertation for obtaining the educational and scientific degree "Doctor" in: field of higher education 6.0 Agricultural Sciences and Veterinary Medicine, professional field 6.1 Plant Breeding, scientific specialty Ornamental Plants

Author of the dissertation: Land. Arch. Maria Petkova Grozeva

Doctoral student in independent training at the Department of Horticulture at the Agricultural University, Plovdiv

Topic of the dissertation: "Typology and methods of noise protection through the use of green plantings in urban environments"

Member of the scientific jury: Assoc. Prof. Dr. Nadezhda Gencheva Zapryanova, Agricultural Academy, Institute of Ornamental and Medicinal Plants - Sofia, professional field 6.1 Plant breeding, scientific specialty "Ornamental Plants", appointed as a member of the scientific jury by order No. RD-16-776/23.06.2026 by the Rector of the Agricultural University

1. Brief introduction of the candidate.

Maria Petkova Grozeva was born in 1980 in Ashgabat, Republic of Turkmenistan. In 2006, she graduated from the Forestry University - Sofia with a degree in Landscape Architecture and acquired the professional qualification "Master of Landscape Architect". Since 2017, she has been a doctoral student in independent training at the Department of Horticulture at the Faculty of Viticulture and Horticulture of the Agricultural University - Plovdiv. She was enrolled with Order No. RD-26-55/29.06.2017 and was enrolled with the right to defense with Order No. RD-16-560/30.04.2025 of the Rector of the Agricultural University - Plovdiv.

In the period 2004–2008, she was the manager of "Landscape Project" OOD and developed design and consulting activities in the field of investment design. From 2008 to 2017, she worked as an expert in "Green System and Recreation" at the OP "Sofproekt - OGP", where she participated in the design and management of investment projects and programs. In 2017–2018, she was the manager of "MG Studio" EOOD, and from August 2021 to the present, she has been managing the company again.

Her administrative and managerial experience is also significant. In the period June 2018 – August 2021, Maria Grozeva was the Deputy Mayor of the "Mladost" district - Sofia Municipality, with the portfolios of ecology, education, sports, culture and social activities. This position implies direct participation in the organization, coordination and control of activities related to the quality of the urban environment, public infrastructure and the implementation of municipal projects and programs.

The candidate has practical skills in working with AutoCAD, CorelDRAW and standard office applications, as well as experience in communicating with administrations, departments, clients and project teams.

Her professional profile is complemented by awards: First prize in a competition for the development of the space around the Literary Stara Zagora Museum (2018); First prize for a square space in the city of Stara Zagora (2013); First prize in the "Development plans, park development and landscape preservation" section of the "Archidea" competition (2008); Audience award in the "Urban planning" section of the "Archidea" competition (2007); and the "Landscape Architect of the Year" award for 2022.

The indicated education, professional experience and implemented design activities are directly related to the topic of the dissertation. They explain the author's good orientation towards the real problems of transport noise, urban planning restrictions and the possibilities for the application of green noise protection screens in investment design.

2. Relevance of the problem.

The topic of the dissertation is relevant and has a clearly expressed scientific and applied significance. The relevance stems both from the existing problem with noise pollution in large urbanized areas and from the need to develop scientifically sound, environmentally sustainable and adapted to local conditions approaches to noise protection. The focus on creating a typology and methodology for using green spaces as a functional part of the acoustic protection system gives the study a modern interdisciplinary character and determines its significance for landscape architecture, urban planning and the practice of building and managing the green system.

A significant argument in support of the relevance are the own results obtained in the dissertation from monitoring the acoustic environment in Sofia. Research in representative areas with intensive transport traffic has established an excess of permissible noise levels by 5 to 12 dB(A), which confirms the presence of a real acoustic problem in the studied urban environment and the need to implement adequate engineering and environmental measures.

The scientific relevance of the study is enhanced by the lack of regional studies on the conditions of Bulgaria, as well as the limited possibility of directly transferring foreign models to the specific urban planning characteristics of Sofia.

Of significant importance is also the question raised in the dissertation work about the seasonal dynamics of vegetation and the related change in noise protection efficiency, especially in broad-leaved species during the winter period. This justifies the need to develop solutions that provide a sustainable noise protection effect during different seasons.

3. Degree of knowledge of the state of the problem and creative interpretation of the literature review.

The presented literature review and the significant number of cited sources demonstrate a thorough knowledge of the state of the problem considered in the dissertation work and are a convincing argument for its relevance. It is thematically well structured and demonstrates knowledge of the classical and contemporary statements on the propagation of noise, spatial planning, noise protection barriers, green infrastructure and ecosystem services. 157 sources are cited, of which 35 in Cyrillic and 122 in Latin. Regulatory documents, methodological sources and publications in specialized international publications are used. The doctoral student does not limit herself to a descriptive review, but brings out the main

factors determining the effectiveness of plant screens: density and storey of plantings, width of the belt, participation of evergreen species, ground shrub layer, seasonality, relief and distance from the noise source. A convincing connection is made between the theoretical statement and the subsequent field and project work.

4. Purpose, tasks, hypotheses and research methods. Compliance of the selected research methodology with the set purpose and tasks of the dissertation.

The purpose of the dissertation is clearly and specifically formulated: To develop scientifically based typological models and methodological guidelines for the construction of highly effective biological screens in the Sofia agglomeration and clarify the noise protection potential of tree and shrub vegetation in a real urban environment. To achieve it, the doctoral student has formulated five logically ordered and interrelated tasks. They include analysis of the mechanisms of noise propagation and attenuation, instrumental in situ monitoring, assessment of the seasonal factor, dendrological analysis, development of digital phytoacoustic models and constructive typology.

The working hypothesis, according to which properly selected and spatially organized vegetation can provide a measurable and sustainable noise protection effect, accompanied by additional environmental benefits, is clearly stated and consistently verified in the course of the study.

A complex methodology was applied, including field measurements with a digital sound level meter class 2, analysis of 19 control points and specialized locations, comparison of results during the summer and winter periods, assessment of plant structures and development of project cases. The measurements were organized through positions at the noise source and behind the plant barrier, at a regulated distance and controlled meteorological conditions. The methodology is adequate to the set goal and creates an opportunity for an integrated assessment of acoustic, dendrological and spatial design indicators.

5. Visualization and presentation of the obtained results.

The dissertation work is structured according to the requirements and includes: literature review; goal, tasks and hypothesis; materials and methods; results, including analysis of field data; design methodology and applied models, conclusions and used literature.

The development has a volume of 210 pages and contains 29 tables and 30 figures, which provide a clear and concise visualization of the results.

The results are presented through tables, diagrams and comparative analyses. The data on the seasonal change in the noise protection effect and on the different spatial structures of the vegetation belts are particularly informative.

A good side of the work is the combination of measurements with real objects and design solutions - boulevards "Alexander Malinov", "N. Y. Vaptsarov" and "Macedonia", park "Kazichene", residential complex "Botevgrad" and shopping complex "Technopolis" located in an urban environment with high noise pollution from car traffic.

6. Discussion of the results and used literature.

The results of the study are in full accordance with the formulated goal and the tasks set. They are interpreted clearly and consistently, and a connection between the experimental data and the acoustic and biological mechanisms of noise protection has been established.

A significant contribution is the establishment of the so-called "phenological collapse" in completely broad-leaved plant belts, the effectiveness of which during the winter period is significantly reduced. This justifies the need to include evergreen species and to form a continuous ground shrub layer.

The conclusions on the influence of the width of the belt, its vertical continuity and the combination of plant and solid noise protection barriers are valuable. The practical value of the proposed biological solutions is also argued through a technical and economic comparison with conventional noise protection walls.

The cited literature has been used correctly and supports the interpretations and conclusions made.

7. Contributions of the dissertation.

The reference for contributions reflects the most important achievements of the developed dissertation. The contributions can be defined as scientific-applied, with a clearly expressed practical focus.

Of particular value is the binding of the obtained experimental data with specific design recommendations. The developed models and guidelines expand the possibilities for practical application of vegetation as an element of urban noise protection. "

Scientific contributions:

- Definition of the physical-biological mechanism: It has been scientifically proven that phytoscreens function as a complex system for sound energy dissipation through a synergy of absorption, diffraction and microreverberation.
- Proof of seasonal (phenological) dynamics: The "phenological collapse" in acoustic efficiency in completely deciduous massifs during the winter period has been quantitatively measured and proven.
- Development of a Mathematical Model of Acoustic Transfer: A model for quantitative calculation of Insertion Loss has been created.

Scientific and applied contributions:

- The development of an integrated approach for assessing the phytoacoustic potential of tree and shrub vegetation, combining acoustic measurements, dendrological characteristics and spatial indicators;
- The formulation of design principles for the construction of plant noise protection screens, taking into account the width and vertical continuity of the belt, the species composition and its combination with solid barriers;
- The development of methodological guidelines and application models for use in landscape architecture and urban planning practice.

Applied contributions:

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

8. Assessment of the degree of personal participation of the dissertation candidate in the contributions.

The content of the dissertation, the independent nature of two of the publications and the professional experience of the candidate give reason to assume that her personal participation in the development of the topic, field observations, data processing and formulation of the applied models is significant. The personal contribution is manifested mainly in the linking of acoustic measurements with specific dendrological and design solutions.

9. Critical notes and questions.

The notes on the paper are mostly recommendatory and do not change my positive assessment.

The evidential strength of the results would be increased by a more detailed presentation of the number of repetitions, the uncertainty and calibration of the measuring equipment, as well as the methods used for statistical data processing.

When comparing the measurements before and behind the vegetation barrier, the effects of vegetation should be more clearly distinguished from the influence of distance, relief, sound reflections and the type of pavement. In future studies, it is advisable to include more parallel control measurements in areas without vegetation.

My questions to the doctoral student are:

- How can traffic noise be reduced in playgrounds and recreation areas in urban environments through optimized spatial planning and use of vegetation barriers?
- Which characteristics of ornamental trees and shrubs determine their effectiveness as green noise barriers in urban environments?
- What experimental design would you apply to quantitatively separate the effect of the vegetation barrier from the effects of distance, relief, and hard barriers in the same urban profile?

10. Published articles and citations.

Two publications thematically related to the dissertation work are presented. They are independent publications of Maria P. Grozeva from 2023 in the journal Agricultural Sciences

- 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

- 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

According to the presented scientometric report, the publications are in editions, referenced and indexed in world-renowned databases with scientific information, forming a total of 70 points under indicator D.

No data on citations are provided in the materials provided.

11. Assessment of publications on the dissertation: number, nature of the editions in which they were printed. Reflections in science - use and citation by other authors.

The publications are in direct thematic connection with the dissertation and reflect its essential aspects - design of solutions for reducing transport noise in children's and recreational spaces and the application of a linear park as a means of reducing noise pollution.

They are sufficient in number and nature, and the independent authorship of two of them supports the assessment of the personal contribution of the doctoral student.

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

CONCLUSION:

Based on the various research methods learned and applied by the doctoral student, the correctly conducted experiments, the generalizations and conclusions made, I believe that the presented dissertation work meets the requirements of the Law on Agricultural Research and Development of the Republic of Bulgaria and the Regulations of the Agrarian University for its application, which gives me reason to evaluate it **POSITIVELY**.

I would like to propose to the esteemed Scientific Jury to also vote **POSITIVELY** and award to Land. Arch. Maria Petkova Grozeva the educational and scientific degree "**DOCTOR**" in the scientific specialty "Ornamental Plants" from the professional direction 6.1. "Plant Growing", in the field of higher education 6.0 "Agrarian Sciences and Veterinary Medicine".

Date: 11.09.2026

Sofia

Reviewer: .

Assoc. Prof. Dr. Nadezhda Zapryanova

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