# REVIEW

on the dissertations for obtaining the educational and scientific degree **'Doctor'**, in the field of higher education 6. Agrarian sciences and veterinary medicine, professional area 6.5. Forestry, scientific specialty 'Forest plantations, selection and seed production' in Forest Research Institute – Bulgarian Academy of Sciences.

**Author of the dissertation:** Nikolay Yanchev Stoyanov, doctoral student of independent training
**Dissertation topic:** 'Distribution, variability and health status of *Ulmus* species in Northern Bulgaria'
**Member of the scientific jury:** Prof. Margarita Ilieva Georgieva PhD - field of higher education 6. Agricultural sciences, professional field 6.5. Forestry, the scientific specialty 'Forest melioration, forest protection and special uses in forests' (order № RD-15-298/14.07.2021 of the Director of the Forest Research Institute - BAS.

**1. Brief introduction of the doctoral student.**

Nikolay Yanchev Stoyanov was born on 19 September 1974 in the town of Svishtov. In 1997 he graduated from the University of Forestry - Sofia, where he obtained the educational qualification degree 'Engineer' in the Faculty of Forestry. In the period 2007-2008 he obtained the master's degree in Plant Protection at the Agricultural University - Plovdiv, Faculty of Plant Protection and Agroecology. During the period 2019-2021, Eng. N. Stoyanov studied as a PhD student in independent training in the scientific specialty 'Forest plantations, Selection and Seed production' in the Department 'Forest Genetics, Physiology and Cultures' at the Forest of Forestry - BAS. During the training, the doctoral student achieves 462 credit points (with a minimum required 250 points), successfully completing his educational program and deducted with the right to defence (Order №15-235 of 10.06.2021). After completing his higher education, Eng. N. Stoyanov held positions as a Senior expert at the Seed Control Station - Sofia, a Director of the Forest Protection Station - Sofia, as well as a sales representative and manager in private companies. He is currently the manager of Al and Yves Forest Consult for the implementation of activities related to forest protection and protection of forest areas and services in agriculture and forestry.

**2. General characteristics of the dissertation - volume and structure.**

The presented dissertation contains a total of 232 pages, of which 110 pages of text, 12 pages of references and 110 pages of appendices. In connection with the study and the results of the study on the distribution, variability and health status of species of the genus *Ulmus* in Northern Bulgaria, 15 tables and 39 color graphs and photographs are presented, which serve as a basis for analysis and comparison of the results.

**3. Relevance of the problem.**

Representatives of the genus Elm (*Ulmus* spp.) are components of natural deciduous forests and used as ornamental urban and park trees in Europe, North America and parts of the Southern Hemisphere. In Bulgaria the different species of elm participate in the composition of different forest growing communities. In recent decades, large areas of mature plantations of European or North American origin have died by a destructive disease called Dutch elm disease. The disease first appeared in the early 20$^{th}$ century by the fungal pathogen *Ophiostoma ulmi*, and the more closely related, more aggressive species *Ophiostoma novo-ulmi* is now prevalent. Both fungal pathogens are non-native species to North America and Europe, and for Bulgaria.

The presented dissertation is an original scientific related to the study of the distribution, variability and health status of the species of the genus *Ulmus*, participating in the composition of the forest plantations on the territory of Northern Bulgaria. The conservation of elm species has been an extremely important topic for the world scientific community in recent decades. A promising direction is the selection of sustainable elm varieties that are able to overcome the Dutch elm disease and preserve the species as valuable for forestry and landscaping. Research in the field of selection, genetics and forest protection is not only important theoretically but also applied, due to the proven and repeatedly confirmed opportunities to improve the condition of the elm genetic fund by selecting resistant individuals and hybrids of species of the genus *Ulmus*.

**4. Literary awareness.**

The presented list of references includes 155 titles, of which 66 in Cyrillic and 89 in Latin. Regarding the analysis of the state of the problem in the literature review, the doctoral student makes an extensive review of scientific research related to the analysis of phylogeny and taxonomy of the Elm family (Ulmaceae), and characteristics of the genus Elm (*Ulmus* spp.), Their varieties and hybrids distributed in Bulgaria. Studies related to the selection of forms of naturally distributed elm species for landscaping, the creation of sustainable protective forest belts and forest plantations, and the elucidation of the genetic structure of elm populations, tracing the most common causes of damage from biotic and abiotic nature. Information is presented on scientific and practical programs in the countries of Europe and North America for conservation of the genetic fund of species of the genus *Ulmus* by using in-situ and ex-situ methods to create hybrid forms resistant to Dutch elm disease and others.

Most of the review of the published information was found in foreign literature, which leads to the conclusion that studies on the variability and sustainability of elm species in Bulgaria are generally scarce, and this in turn is another convincing evidence of the relevance of the selected topic. The prepared literature review allowed the PhD student to formulate correctly the purpose of the research and to identify tasks to clarify the issues that arose.

**5. Aim, tasks and research methods.**

The aim of the present dissertation is to study the existing elm plantations and separate groups of species distributed on the territory of Northern Bulgaria, their diversity in terms of a number of morphological indicators, as well as the growth of seedlings from selected branches in experimental plantations.

In fulfilment of this goal, tasks have been set related to the analysis of the condition of the elm genetic fund and mapping of the established localities; study of the biological diversity in the natural habitats by representatives of the genus *Ulmus* in terms of the presence of ecotypes and forms, selection and differentiation of seed production plantations and plus trees and proposal for their inclusion in the National Register of Forest Seed Production Base, preservation of the valuable genetic fund by representatives of the genus *Ulmus* by *in-situ* and *ex-situ* methods.

The methods used in conducting the experimental part of the dissertation correspond to the set tasks. In his work the PhD student has mastered and successfully applied methods related to collecting information about the silvicultural and selection characteristics of the studied plantations, as well as for mapping the distribution of the studied species of the genus *Ulmus* in the selected sites. The dissertation uses established methods for performing a comprehensive assessment of the health status of the test trees. Experiments were performed by applying classical methods for the study of seed regeneration, vegetative propagation by cuttings, *in-vitro* propagation, and protection of the selected forest genetic background by the *ex-situ* method of individual elm widows - the subject of the study.

**6. Significance of the obtained results, interpretations, visualization and conclusions.**

The section Results and discussion is presented on 62 pages, divided into five subsections - 1) distribution of the representatives of the genus *Ulmus* in the Regional Forest Directorates, 2) study of the variability of the species of the genus *Ulmus*, 3) study of the health of the stands in the permanent sample areas, 4) preservation of the genetic resources by the *in-situ* and *ex-situ* methods and 5) construction of a branch archive.

To assess the distribution of three elm species - *Ulmus laevis* Pall, *Ulmus minor* Mill. *Ulmus glabra* Huds., data from six Regional Forest Directorates (Veliko Tarnovo, Lovech, Shumen), Ruse, Berkovitsa and Sofia), were analyzed. Based on the processed materials, the percentage share of the studied species in the inventoried plantations, their distribution by altitude, age, quality, origin, etc. was estimated. The analysis of the obtained results shows that the species of the genus *Ulmus* participate in the composition of a large number of plantations, but rarely have a predominant participation, as the largest area is occupied by elm forests on the territory of RFD Ruse, followed by those in RFD Lovech, at the age of 60-80 years. It was found that the trees aged 81-100 years were severely damaged or killed by Dutch elm disease.

Field elm is characterized by the greatest variability in terms of the studied morphological features (forms of bark, crown, leaf petiole and twigs), and mountain elm by the least. Selected single trees and plantations show that *U. laevis* saplings have faster growth than those of *U. minor*. In the section on the assessment of the health status of elms in the studied experimental areas, it is stated that the Dutch elm disease (caused by *Ophyostoma ulmi*) is widespread throughout the study area, mainly affecting field elm plantations, and mountain and white elm are more weakly affected. The single trees and groups of *U. pumila* L. found and described in the study area show good vitality to the growing conditions in our country.

**7. Contributions to the dissertation.**

As a result of the developed dissertation the doctoral student has formulated the following scientific and scientific-applied contributions:

**Scientific contributions**

• The plantations were categorized by studying the variability of the species of the genus *Ulmus* in Northern Bulgaria according to morphological features.

• The health status of the studied species of the genus *Ulmus* in Northern Bulgaria has been established and the main fungal pathogens and insect pests causing damage to trees have been identified.

**Scientific and applied contributions**

• An information database has been created, including the location of the representatives of the genus Elm (*Ulmus* spp.) In Northern Bulgaria, the degree of their distribution and vitality;

• A laboratory protocol for *in-vitro* propagation of *Ulmus laevis* Pall has been developed and its introduction into modern in-situ and ex-situ propagation programs has been proposed;

• 170 plus trees of the genus *Ulmus* have been selected and 12 plantations for seed production have been proposed, included in the forest seed production base;

• Recommendations have been made for improving the technology for the production of seedlings and the creation of forest crops from different types of elm;

• Experimental crops have been created for the construction of a branch archive of different types of elm.

**8. Critical remarks and questions.**

To the PhD thesis dissertation I have the following critical notes related to the form and content of the text, the exposition of the text and the figures, as well as the conclusions made:

• The text of the dissertation is not well presented in terms of formatting and arranging the individual sections. A large number of grammatical and technical errors were made, as well as incorrect spelling of the subdivisions and Latin names of individual taxa of plants or fungal pathogens according to their rank in the given classification (family, genus, species). It is noteworthy that in the presented publications, the texts are printed without grammatical and taxonomic errors, and the photographic material of the maps and the photographed objects are of much higher quality than those contained in the dissertation.

• The text does not cite titles that are cited in the literature and vice versa, such as. Georgiev et al. (2017). All citations in the text include initials of the authors.

• The subsection assessing the health status of the studied elms is presented in a very short version in the dissertation, where there is no current reference for the current spread of Dutch elm disease, which is the main reason for the deteriorating health of certain elm species in Bulgaria. In this regard, does the doctoral student have information about the current spread of the disease in the Regional Forest Directorates of in Northern Bulgaria?

• The damage factor values are not presented as a weighted average, as indicated in the Method of Operation section. The values of the complex assessment in almost 30% of the experimental areas are indicated as 0 - healthy trees, which does not correspond to the conclusion that the Dutch elm disease is ubiquitous.

• The symptoms of diseases and damage from insect pests in the studied areas are not well presented, there is no photographic evidence of the samples taken from the trees and the isolated pure mycelial cultures, proving that the pathogen *Ophiostoma ulmi* is the cause of the deteriorated condition of the studied plantations.

**8. Evaluation of the quality of scientific publications.**

The presented abstract objectively reflects the structure and content of the dissertation. Its volume is 41 pages, which includes 22 tables and 52 color figures and graphs. The dissertation is accompanied by a list and prints of 7 scientific papers, of which four publications published in Bulgarian in the journals *Forest Science*, *Forestry ideas* and the *Journal of Science New Knowledge*, and three - in English in international journals *Investigación agraria Sistemas y recursos forestales*, *Analele ICAS* and a published report in the *Proceedings of the 2nd Congress of Ecologists of Macedonia*. The presented publications reveal the results obtained at different stages of the work on the dissertation and meet the accepted requirements for acquiring Doctor degree at the Forest Research Institute - BAS. Two of the publications are independent, and the other five are co-authored, and in two of them N. Stoyanov is the first author. No list of citations is presented.

**9. Personal contribution of the doctoral student.**

The contributions are the personal work of the PhD student. Field surveys and experimental experiments were performed to study the distribution, variability and health status of elm species distributed in Northern Bulgaria. In this regard, the dissertation of doctoral student Nikolay Stoyanov corresponds to the scientific specialty and the professional field in which the study was developed. Particularly valuable are the results obtained in the experimental work for the study of micropropagation, *in-vitro* encapsulation of individuals of *U. laevis*, as well as the use of growth regulators for the evaluation of alternative methods of reproduction, which requires very good theoretical and methodological training.

**CONCLUSION:**

Based on the different research methods learned and applied by the PhD student, the correctly performed experiments, the summaries and conclusions made, I believe that the presented dissertation meets the requirements of Low for Development of the Scientific Staff of the Republic of Bulgaria and the Regulations on the terms and conditions for obtaining the educational and scientific degree and holding academic positions in Forest Research Institute - BAS, which gives me reason to evaluate it **POSITIVE**.

I allow myself to propose to the esteemed Scientific Jury to vote positively and to award to **Eng. Nikolay Yanchev Stoyanov** the educational and scientific degree '**Doctor**' in the field of higher education 6. Agricultural Sciences and Veterinary Medicine, professional field 6.5. Forestry, scientific specialty 'Forest plantations, selection and seed production'.

Date: 07.09.2021 г. PREPARED THE REVIEW:

Sofia /Prof. Margarita Georgieva, PhD/