REVIEW

on the Ph.D. thesis entitled: Distribution, variability and health status of the species of g. *Ulmus* sp. in the Northern Bulgaria

written by Nikolay Yanchev Stoyanov

Domain of higher education – 6. Agricultural sciences and veterinary medicine; professional direction 6.5. Forestry, scientific specialty Forest plantations, breeding and seed production.

Reviewer and member of the scientific committee: Dr. Petar Zhelev Stoyanov – Professor of Forest Genetics, University of Forestry

1. Brief bio of the Ph.D. candidate

Nikolay Yanchev Stoyanov graduated in 1997 with a degree M.Sc. in Forestry from the University of Forestry (UF). In 2008 he got another M.Sc degree – in Plant protection – from the Agrarian University in Plovdiv. He worked as researcher in the UF (1997-1999), as senior expert (1999-2007) and Director (2017-2019) of the Forest Protection Station, and also in private companies. He took part in the introducing of the European legislation in the forest seed control, in a team for preparation of applications to the Programme Life +, and he organized trainings for strengthening the capacity of experts in the forestry sector.

As a part of his Ph.D. studies, he took the necessary exams (three) and according to the credit system for Ph.D. students in the Bulgarian Academy of Sciences (BAS) he was assigned 462 points (250 required).

2. General characteristics of the Ph.D. thesis – volume and structure.

The thesis is written on 125 pages main text and 33 pages Appendix. The main text encompasses 14 tables and 28 figures. The appendix consists of 9 tables, 9 maps, characteristics of 28 experimental plots, of the experimental trials and passports of the selected plus trees. The reference list consists of 99 literature sources.

The introduction section, encompassing also the main objective and the tasks set, is written on 2 pages. The literature survey is on 22 pages, objects and methods of study – on 6 pages, and the results and discussion – on 80 pages. The conclusions occupy 5 pages. This distribution indicates that the most important part of the work (as page numbers) is dedicated to the results obtained.

3. Relevance of the problems

The relevance of the problems studied in the thesis of Nikolay Stoyanov is outlined first, by the importance of *Ulmus* species for the forestry and for maintaining of high dendrological diversity in the forests. Second, the health status of the *Ulmus* species and their stands are of crucial significance because these species are affected by the Dutch Elm Disease (DED). And third, the variation in the natural populations of the target species has not been studied in detail in Bulgaria.

4. References

As mentioned above, the references list contains 99 sources, which shows the good literature awareness of the Ph.D. candidate. The most important studies concerning the problems related to the thesis, are cited.

5. Objectives, tasks and methods of study.

The objectives and tasks are presented in the Introduction section. They define the thesis as interdisciplinary, including studies in the fields of tree breeding and forest protection in the broadest sense. Therefore, the methods are diverse and specific, like selection method, method of experimental plots, for seed testing, for in vitro propagation and statistical methods for data processing. The set of methods is appropriate for achieving the goal and tasks set and for getting of reliable results.

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

As a result of long-term studies, the author found many new facts and trends related to the distribution, health status and polymorphism of the target species. The results impress with their amount, which can be explained, at least partially, by the long period of study.

The analysis of the species distribution deserves high evaluation – it is an issue still not studied in detail. This is due to the fact that the species are not considered in the forest management plans when they are represented only by single individuals. The issue with the White elm is particularly interesting – in the "official" botanical literature (see, for example, the Conspectus of the Bulgarian Vascular Flora; Assyov and Petrova, eds., 2012) it is not included in the indigenous flora of the Danube plain, while at the same time it occurs along almost all the tributaries of Danube and along the Danube itself, including on the islands.

The variation of the three Ulmus species in the Northern Bulgaria is also studied in detail.

The part on the gene conservation presents original results related to the methods of propagation of the tree species. These results complement and enrich the diversity of methods applied by the author.

The appendices after the main text are useful and necessary, because they help the reader to get better orientation and to evaluate the studies performed.

The thesis is illustrated by different figures – charts, photos and maps.

7. Contributions of the thesis

The most important contributions are the following ones:

- The distribution of the target species in the region of study is studied in detail. As noted above, this issue is underestimated both in the forest management plans (in the case of single individual occurrence) and in the botanical literature.
- The variation of the three *Ulmus* species in the region was studied based on a set of phenotypic traits – stem form, crow form, bark configuration, leaf shape, reproductive organs. The percentage ratio among the different forms in the populations was recorded.
- Seed characteristics (germination capacity and energy) of the tree Ulmus species were characterized and the results revealed considerable variation among the different populations and years of testing.
- Some characteristics of the seedlings were described at early stage of their development and some traits could be used for early diagnosis. The results are compared with these recorded for a hybrid (*U. minor x U. pumila*).
- The growth and status of the species in the experimental plantation trials were studied in detail.
- A profound evaluation of the health status of the target species in the sample plot was performed. The most important pests and diseases were established, as well as the damages caused by abiotic factors, which is a prerequisite for measures aimed at improvement of the health status of the target species.
- The most valuable stands were identified in relation to in situ gene conservation and 43 plus trees were selected and documented.
- Trial plantations and clone collection were established with the aim of *ex situ* ca gene conservation.
- Again, in relation to *ex situ* conservation, the possibilities for vegetative propagation of the Elm species were studied, both *in vivo* and micropropagation *in*

vitro, together with studying the effect of two growth regulators on the in vitro propagation success.

- The conclusions and recommendations are sound and are based on the studies performed.

8. Critical notes and recommendations

The critical notes address some technical errors and cannot change the high evaluation of the thesis. I repeat some notes addressed at the previous stage of approbation, like:

- The words **"g. *Ulmus* sp."** is misleading from the taxonomic point of view. However, the work is not taxonomic.

- There are some discrepancies in the thesis structure. Chapter II is repeated – once the part "Objects and methods of study" is denoted as part II, and later the part "Results and analysis" is denoted again as Chapter II. The next parts – about the variation, health status and gene conservation – are also presenting results. Therefore, all they could be merged as a common chapter with several sub-chapters. Chapter VI is missing – after the chapter V there is chapter VII – Conclusions and recommendations. As it can be seen and as it is noted abpve, these are purely technical errors.

There are also some terminological imperfections, for example, that the systematics of *Ulmus* species ***was done*** according to Flora of Bulgaria (p. 29), or that "*Ulmus pumila* ... has successfully introduced itself to the growth conditions (p. 114) and some others, but as mentioned above, these minor errors do not decrease the importance and the high evaluation of the thesis.

9. Scientific publications related to the thesis

There are seven papers published – three single-authored and four with co-authors. Thes papers present substantial parts of the thesis. Four of the publications are in Bulgarian, and three – in English. Six papers are published in scientific journals; four of them in Bulgarian, and two – in foreign journals. The quality and amount of the publications meet the respective requirements set in the documents of the FRI-BAS and by the credit system for training Ph.D. students in BAS.

10. Personal contribution of the Ph.D. candidate

The personal contribution of the Ph.D. candidate is reflected in the large-scale field studies during more than two decades, in the inventory of the natural populations, in the

establishment of the trial plantations and clone collections, and finally – in the data processing and writing of the thesis and publications. He is a researcher, who had proven his ability to work independently.

CONCLUSION:

The thesis of Nikolay Stoyanov is of interdisciplinary character, with numerous diverse methods applied and respectively with many important results achieved. Based on the outlined positive characters of the thesis, I believe that it meets the requirements of the legislative documents for obtaining scientific degrees in BAS.

I highly evaluate the Ph.D. thesis and could recommend to the Scientific Committee to award to Nikolay Yanchev Stoyanov the degree Doctor of Phylosophy (Ph.D.). in the domain of higher education – 6. Agricultural sciences and veterinary medicine; professional direction 6.5. Forestry, scientific specialty Forest plantations, breeding and seed production.

Date: 13.09.2021 г. REVIEWER:

/Professor P. Zhelev, Ph.D./