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# REVIEW

**From:** Prof. Dr. Nadja Georgieva Ognjanova-Rumenova
Geological Institute at BAS, Member of the Scientific Jury, appointed by Order № 268 / 10.12.2020 of the Director of the Institute of Oceanology at BAS-Varna

**Subject:** submitted documents for defense of a dissertation for obtaining an educational and scientific degree "Doctor" in the area of higher education 4. Natural sciences, mathematics and informatics, professional field 4.3. Biological Sciences, Doctoral program "Ecology and protection of ecosystems", Research topic "Macrophytobenthos" (Seagrass)"
**Author**: Elitsa Valentinova Hineva
**Topic:** Ecological factors limiting the distribution of the seagrasses of the genus *Zostera* in the sublittoral zone of the Burgas Bay (the Black Sea): importance of wind waves and epiphyte abundance
**Scientific superviser:** Prof. Snezhanka Moncheva, PhD

## 1. General characteristics of the dissertation

The set of materials presented in electronic form by Elitsa Valentinova Hineva is in accordance with the Regulations for the conditions and procedures for acquiring scientific degrees and for holding academic positions at the Institute of Oceanology at BAS and includes the following documents: * Dissertation * Abstract * List of publications and participation in scientific forums with copies of articles and abstracts on the topic of the dissertation * Curriculum vitae in European format * Diploma for obtaining a master's degree * Minutes of the extended seminar of the section "Marine Biology and Ecology", IO / 17.11.2020 * Information on the study process and credits * Summary of the dissertation in English.

The dissertation has a volume of 247 pages and is structured according to the rules for preparing a dissertation in 10 chapters, as follows: Introduction (3 pages), Literary review (16 pages), Purpose and objectives of the study (2 pages), Material and research methodology (34 pages), Results and discussion (132 pages), Summarized results and conclusions (3 pages), Contributions (1 page), Publications on the topic of the dissertation (1 page), Bibliography (14 pages). The bibliography includes 211 titles, of which 33 in Cyrillic, 169 in Latin and 9 on the Internet. The dissertation contains 24 tables and 122 figures, including photographs, included in the main text. The work is well balanced, and justifiably the most voluminous part is "Results and discussion". Part of the dissertation is Appendix №1 (32 pages). Impressive is the good technical layout of the dissertation and especially the high quality figures and tables that illustrate and

support the interpretation of the results. A list of abbreviations used has also been drawn up. The goal is clearly and precisely set, the tasks for its realization are concretely and correctly presented and substantiated. Three working hypotheses have been formulated - a good basis for solving the set tasks.

**Brief biographical data about the doctoral student.** Elitsa Hineva holds a Master's degree in Ecology and Environmental Protection, specializing in Marine Ecology, at the Higher Naval School "NY Vaptsarov" - Varna (2002). Her professional experience includes a short period of work at the Institute of Fisheries and Aquaculture, Varna, as well as an eight-year period as an expert ecologist in the Black Sea Basin Directorate, Varna. Since 2012 he has been an ecologist and doctoral student at the Institute of Oceanology at the Bulgarian Academy of Sciences, Varna. She has conducted several consecutive specializations in: Institute of Biology of the Southern Seas, Sevastopol (Ukraine); University of Groningen, Department of Marine Biology, Groningen (Netherlands); VFU "Chernorizets Hrabar", Varna; GEF-UNDP-IMO-GloBallast - project, Commission for Protection of the Black Sea from Pollution and Caspian Environment Program, Batumi (Georgia); Argon and IAEA National Laboratory, Monaco (Monaco); IBEI, Reykjavik University, Eastern and Southern Network for Invasive, Alien Species and Danube Network for Invasive, Alien Species, Sofia (Bulgaria). Elitsa Hineva is a doctoral student in self-study.

**2. Literary awareness and theoretical preparation of the candidate**

The author is well acquainted with research worldwide, as well as in the Black Sea, related to the two main environmental factors determining the spatial distribution of seagrass. The literature reference is structured in two sections. These two current trends are presented in depth and detail: * the importance of turbulence as a factor in the distribution of aquatic angiosperms and * the impact of eutrophication in marine macrophyte communities. This is confirmed by the attached bibliographic reference, creatively used in the research and analysis made in the dissertation. The main emphasis is modeling as an approach in studying the wave impact on seagrass. In the models of spatial distribution of seagrass, the pair "sea wave - light climate" almost invariably participates in support of the thesis that the two factors outline the roughest and widest boundaries of the spatial ecological niche of the species inhabiting soft bottoms. The relevance of the dissertation topic is confirmed by the fact that in this detailed

literature review of the Bulgarian Black Sea coast there are isolated studies on the effect of waves on grasslands.

**3. Material and methodical approach**

The research is based on rich factual material. A detailed physical-geographical characteristic has been made, which shows that a relatively small area in the Burgas Bay presents a huge variety of habitats, due to the combination of natural characteristics (relief, water bodies and land cover of the catchment area, wind climate, coastal exposure and underwater relief) and anthropogenic impact (land use, discharges, regulation of freshwater and solid inflow, hydraulic engineering). This allows seagrass fields to inhabit a variety of conditions and is a good base for research.

The methodological approach in the development of the dissertation is characterized by three strengths: (i) the focus on the formulated three working hypotheses; (ii) the adequately selected study area; (iii) the modern methodology of analysis and testing of hypotheses based on rich factual material; I believe that the doctoral student has excellent theoretical and methodological training.

**4. Significance and conviction of the obtained results, interpretations and conclusions**

The results of the field and ecological researches are bound in defense of the formulated working hypotheses. They are discussed in detail and at a high professional level in the text of the dissertation. They are organized in four sections, corresponding to the set goals and objectives. I believe that the dissertation student Elitsa Hineva is an established researcher in the field of ecology.

The presented distribution of underwater meadows of seagrass in the shallow zone of the Burgas Bay is related to the fact that the available natural fields are concentrated mostly in this part of the Bulgarian water area. Seagrass occupies the shallow coastal areas in front of the Bulgarian coast with a wave exposure ranging from semi-protected to highly protected type of coast. The significance of the wind wave, which determines the distribution of the seagrass in the Burgas Bay, was traced in the conditions of a "deep / shallow wave".

The speed of leaf exchange of the genus *Zostera* is important for the construction and peculiarities of the epiphytic community. The obtained results are in accordance with the cited studies, but show one of the shortest values of leaf duration. In terms of epiphytes, *Zostera* spp.

provide a high level of disturbance: epiphytes have a very short time "window" in which they must colonize the substrate, reach sexual maturity and reproduce. Any ecological factor that affects the rate of leaf metabolism indirectly affects the epiphytic communities. Extremely interesting and significant is the problem related to the relationship between *Zostera noltei* and the parasite *Plasmodiophora bicaudata*, which slows down leaf metabolism and promotes the accumulation of epiphytes on infected plants.

Of particular importance is the practical orientation of research related to the qualitative and quantitative composition of periphyton communities. They can be used to improve maritime monitoring programs in line with the requirements of the Marine Strategy Framework Directive, 2008/68 / EU. The balance between the different direct and indirect effects of water exchange on the periphyton depends on the local characteristics of the environment. In order to assess the direction of the influence of the wave on the individual diatom species, it is necessary to expand the experiment described in the dissertation to include more regions and variables - discharged water quantities, loads of nutrients, C org and BOD5, herbivorous press, salinity, biogenic conditions, composition of phytoplankton, as a source of plankton-benthic species, modeling of transport and transformation of incoming loads.

**5. Critical notes to the dissertation**

The presented dissertation work is developed precisely, the dissertation student has excellent methodological and theoretical training. My critical remarks can serve as a recommendation for her future work.

- In the section "Material and methodical approach" there are no data on the ecological spectra of the periphyton diatomaceous species. It is extremely important to add the authors on whom the ecological preferences are determined. In the bibliography and in the section "Results and discussion" Van Dam et al. (1994) is included, but in this publication freshwater species predominate, and if there are "brackish" present, they are "halophiles".
- To the taxonomic list of periphyton species, included in detail in the Appendix of the dissertation, it is good to have a column with "ecological spectra". In this way, typically

freshwater diatom species such as *Cocconeis placentula*, *Gomphonema olivaceum* var *minutissima* could be distinguished and to be used more precisely in analyzes.

- In determining the varieties within the group of *Cocconeis scutellum* the publication of De Stefano et al. (2008) would be very useful:

*De Stefano, M., Romero, O., Totti, C. 2008. A comparative study of *Cocconeis scutellum* Ehrenberg and its varieties (Bacillariophyta) - Botanica Marina 51(6):506-536. DOI: 10.1515/BOT.2008.058

- I would like to recommend the restriction of foreign words in the text.
- The names of all species of organisms are according to the WORMS database (World Register of Marine Species: http://www.marinespecies.org/. The genus names of the species must be written with "italic".

**6. Nature of scientific contributions**

As a result of the study, summaries and conclusions, the doctoral student formulates six main contributions, presented in two groups: **Scientific contributions**: * Proven limitation of the upper limit of distribution of marine angiosperms by wind waves in the areas: Nessebar Bay, Sozopol Bay, Bay Foros and the lack of limiting (destructive) effect in the Chengene scaffolding area (the mouth of the Marinka River). For each studied area the limiting directions of the approach of the wind waves are established. ** Statistical models of dependence between the upper limit of grass fields and waves have been obtained, which can be applied to unexplored areas with the same or close wave exposure. *** For the first time, the species *Plasmodiophora bicaudata,* parasitizing on *Zostera noltei*, was found off the Bulgarian coast of the Black Sea, which provoked the need for further studies of the mechanisms of the parasite's impact on its host.

**Scientific and applied contributions**: * It has been established that the function for exponential increase to the maximum is the most suitable for estimating the shading caused by the accumulated epiphytes; The coefficients of the equation for the conditions of the Burgas Bay are determined; ** Threshold values for the maximum allowable epiphytic load are derived, depending on the light reaching the epiphytic layer; *** The applied approaches and the obtained results allow purposeful planning and resource substantiation of the activities for research of the

presence of communities of marine angiosperms in different regions of the Bulgarian Black Sea coast with contribution to the optimization of the monitoring programs. I accept the reference of the scientific contributions in the dissertation and consider that they are formulations of original and significant scientific achievements.

**7. Abstract**

The essence of the dissertation is fully and correctly reflected in the presented abstract and it can be stated that it fully meets the requirements of the Law. The abstract includes 37 pages with attached basic graphic materials, the formulated contributions and publications on the topic correspond to those listed in the dissertation.

**8. Evaluation of the quality of the scientific works, reflecting the research by dissertation**

On the topic of the dissertation are attached six publications in full text, written in English, which fully covers the scientometric criteria for awarding the educational and scientific degree "Doctor". Elitsa Hineva is the leading author in all publications. In three of them she is independent author, published in: Proceedings of the Institute of Fishing Resources, Ecologia Balcanika (SJR 2019: 0.135), one is accepted for publication in the Comptes rendus de l'Académie bulgare des Sciences (IF2019: 0.343, Q4); two are co-authored in conference proceedings; the sixth is a co-authored manuscript submitted for review, but no data are available for the journal. The bibliographic description of the publications, attached to both the dissertation and the abstract, must be edited according to international standards.

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

The significant personal participation of Elitsa Hineva in the preparation of the dissertation is indisputable. She is the first author of the dissertation articles, most of which are independent. The presented dissertation work, as well as the formulation of the conclusions and contributions are her personal merit. The scientific guidance of her consultant - Prof. Dr. Snezhanka Moncheva, which is a guarantee for the quality of the research, should also be taken into account.

My personal impressions of the doctoral student are excellent, our acquaintance in the beginning was more "virtual" to guide and help her with literature on epiphytic diatoms. I am happy that I

managed to participate in a training course organized by IBEI, Reykjavik University, Eastern and Southern Network for Invasive, Alien and Danube Network for Invasive, Alien Species on the topic: "Impact of vulnerable alien species on biodiversity and ecosystem services in environments with extreme conditions "in Sofia in 2017. During this course we had the opportunity to communicate, exchange information and introduce it to colleagues working in the field of diatomology.

**Conclusion:**

The dissertation and the presented materials contain scientific and scientific-applied results, which represent an original contribution to science and meet all the requirements of the Law for development of the academic staff in the Republic of Bulgaria (ZRASRB), and the procedure for acquiring scientific degrees and for holding academic positions at the Fritjof Nansen Institute of Oceanology at the Bulgarian Academy of Sciences - Varna. The dissertation shows that the doctoral student Elitsa Valentinova Hineva has in-depth theoretical knowledge and professional skills in the scientific specialty "Ecology and Ecosystem Protection", demonstrating qualities and skills for independent research.

Due to the above, I confidently give my positive assessment of the study presented by the above peer-reviewed dissertation, abstract, results and contributions, and I invite the esteemed scientific jury **to award the educational and scientific degree "Doctor" of Elitsa Valentinova Hineva** in the field of higher education: 4. Natural sciences, mathematics and informatics, professional field 4.3. Biological Sciences, doctoral program "Ecology and Ecosystem Protection".

**Reviewer:**

10.03.2021

Sofia

(Prof. Dr. Nadja Ognjanova-Rumenova)