

REVIEW

on a dissertation work for obtaining the educational and scientific degree "doctor" in: field of higher education 4. Natural sciences, mathematics and informatics, professional direction 4.4 Earth sciences, scientific specialty "Ecology and preservation of ecosystems"

Author of the dissertation: Radoslava Georgieva Zaharieva, full-time doctoral student at the Department of "Agroecology and Environmental Protection" at the Agricultural University, Plovdiv

Topic of the dissertation: "Parasites and parasite communities of fish from the Danube River - ecology and biodiversity"

Supervisor:

Prof. Dr. Diana Kirin

Reviewer: Prof. Dr. Vasil Kostadinov Atanasov from the Faculty of Agriculture at Trakia University, Stara Zagora; Registered in NACID for the scientific degree "Doctor of Agricultural Sciences", in Professional direction 6.3. "Livestock" and "Professor" by field of higher education 4. Natural sciences, mathematics and informatics, Professional direction 4.3. "Biological Sciences", Scientific specialty "Biochemistry", designated as a member of the scientific jury by order No. RD-16-1117/31.10.2022. from the AU Rector.

1. Relevance of the problem.

The presented dissertation work is quite extensive - it is written on 250 pages and contains the standard structural components characteristic of this kind of development. The topic is particularly topical, as it affects parasites and parasite communities of fish from the Danube River. The development is in line with the EU Strategy for the protection of biological diversity until 2030. It is also in sync with the National Strategy for Scientific Research in the Republic of Bulgaria 2017-2030, Specific Objective 1 for the development of the scientific career of young scientists. In this aspect, the development is in accordance with the main priority of Ecology -

protection of biodiversity and the environment, and hence human health. The main thesis of the development, that fish and their parasites can be used as ecological bioindicators, is supported by the applied scientific literature – 206 literary sources were used, of which 45 in Cyrillic and 144 in Latin and 17 online databases. The extensive literature review of more than 30 pages shows the PhD student's excellent awareness of the problem, his in-depth knowledge and great potential for solving important fundamental and practical tasks in determining parasites and parasite communities of fish from the Danube River.

2. Purpose, tasks, hypotheses and research methods.

The goal closely correlates with the title of the dissertation, and the set tasks logically form 5 work packages, the implementation of which is generally related to scientific research on parasites and parasite communities of fish from the freshwater ecosystem of the Danube River. The object of the research is extremely suitable for proving the working hypotheses of the dissertation work, because of the 31 species of fish studied, 29 species are included in the IUCN Red List. Seven of the studied fish species are included in the Red Book of the Republic of Bulgaria, Volume II - Animals, 6 of them are in the "Vulnerable" category and 1 species is in the "Critically Endangered" category. The methods used are adequate to the research, and the modern equipment and methods are suitable for solving the identified tasks. Variational statistical processing of the data was used to determine a number of important dependencies.

3. Transparency and presentation of the obtained results.

The dissertation is written in a good and understandable scientific style. It is very well illustrated with 108 tables and 75 figures. The "Results" section, in fact, also contains a discussion of the obtained data and its relatively skillful interpretation. A general summary was made and 18 items were formulated. conclusions that give a complete picture of the dissertation work. Also presented are 12 scientific and scientific-applied contributions, as well as 8 valuable recommendations for ecology, health care and fishing practice.

4. Discussion of results and used literature.

The dissertation student presents the obtained scientific and applied results in a very well-illustrated "Results" section. The present section presents the results of a helminthological study of 2,367 specimens of fish belonging to 8 families and 31

species, collected from 5 biotopes of the Danube River. During the period 2019-2021, an infestation with 20,391 specimens of helminths belonging to 4 classes (*Trematoda*, *Cestoda*, *Acanthocephala* and *Nematoda*), 22 families, 27 genera and 34 species was found. Synonyms are recorded for each of the established helminth species; taxonomic position; hosts; localization; deposits; occurrence; invasion rank (minimum - maximum); season; brief data on the biology of the species (intermediate and final hosts) and notes on the species. The obtained data are compared with the data of other authors and discussed skillfully with the help of the used scientific literature.

5. Contributions of the dissertation work.

The contributions of each scientific work show its usefulness, both in fundamental and in scientific-applied aspect. In this sense, Radoslava Zaharieva's dissertation is a large-scale study, as a result of which a total of 12 contributions are exposed, which could be briefly summarized and arranged as follows:

Scientific contributions

□ A new species of helminth was identified for the helminth fauna and helminth communities of freshwater fish from the Bulgarian section of the Danube River (*Sch. acheilognathi*). **Original scientific contribution;**

□ 6 types of new endohelminths have been identified for the Danube River and the river basin in Bulgaria. **Original scientific contribution;**

□ 3 types of new endohelminths have been identified for the Danube River and the river basin. **Original scientific contribution;**

□ For 25 species of helminths, new hosts have been established in Bulgaria. For 29 species of helminths, new hosts have been established for the Danube River and the river basin in Bulgaria. For 26 species of helminths, new hosts have been established for the Danube River and the river basin. **Original scientific contribution for Bulgaria;**

□ 22 species of new helminth hosts have been identified for the Danube River and the river basin, including Bulgaria, as well as 18 species of new hosts of helminths in Bulgaria. **Original scientific contribution;**

□ The data on the species composition of the helminths of 25 species of fish from the Danube River have been enriched. **Original scientific contribution.**

Scientific and applied contributions

□ For the first time, the helminth communities of scobar from the Bulgarian section of the Danube River and in Bulgaria were studied. The data on the helminth

communities of bream and bream from the Danube River have been updated.

Original scientific and applied contribution;

□ For the first time, the helminth communities of bream, bream and bream from the Bulgarian section of the Danube River, Kudelin biotope were compared. **An original scientific and applied contribution for Bulgaria;**

□ For the first time, the seasonal differences in the helminth complexes of bream, bream and bream from the Danube River, Kudelin biotope were examined. **Scientific and applied contribution original for Bulgaria;**

□ The scientific literature on research on parasites and parasite communities of fish from the freshwater ecosystem of the Danube River has been enriched. **Original scientific and applied contribution;**

□ New data are provided on the indicators of the invasion of parasites pathogenic to the fish species studied - *Sch. acheilognathi*, *P. laevis*, *Contracaecum* sp., *E. excisus* and *R. acus*. **Original scientific and applied contribution.**

□ New data are provided on the invasion indicators of human pathogenic parasites - *Contracaecum* sp. and *E. excisus*. **Original scientific and applied contribution.**

6. Critical notes, questions and recommendations.

With the exception of some technical inaccuracies, I have no significant comments on the dissertation work and the abstract. However, the interpretation of the rich experimental data in a cross-species aspect could be a little more thorough. For example, the section "Results" could be "Results and discussion", where a wider discussion could find place, which would affect the danger of consuming fish infested with human pathogenic parasites - *Contracaecum* sp. and *E. excisus*.

Given the volume and the high scientific value of the obtained data, I recommend their formation in a monograph related to the dissertation work.

7. Published articles and citations.

The logical conclusion of any research is the publications related to it in prestigious scientific journals. According to the present dissertation, they are 2 nos. in Scientific Papers. Series D. Animal Science /refereed and indexed journals in world-renowned databases with scientific information/. In addition, the PhD student has 3 participations in 2 international scientific conferences – 16 and 17 International May Conference on Strategic Management – 2020 and 2021, in Bor, Serbia, indexed in Web of Science. In all five publications, Radoslava Zaharieva is the lead author,

which is a good certificate for her participation and contribution in the developments.

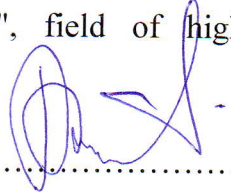
8. Evaluation of the autoref

The abstract is a compressed version of each dissertation work and that of Radoslava Zaharieva has the necessary sections in the reference sequence and volume for similar publications. It is presented on 33 pages and reflects the main information in the dissertation. The exposed results, contributions, conclusions and recommendations are a valuable aid for the collegium in the scientific circles and those working in the field of ecology, health care and the fish farming industry.

9. CONCLUSION:

Based on the above, I believe that the presented dissertation meets the requirements of the RSARB. The topic and the biological species have been selected successfully. The scientific-experimental activity is organized and conducted with skill and competence. The results are obtained and processed with modern methods and equipment. The discussion is current and in tune with modern scientific achievements in the field. Formulated conclusions, contributions and recommendations are valuable for ecology, health care and fish farming practice. The doctoral student, in addition to in-depth theoretical knowledge, also demonstrates enviable skills in analyzing and discussing the obtained results. In this aspect, the training of Radoslava Zaharieva in the doctoral program has achieved the desired result and the materials presented in the procedure exceed the minimum national requirements. I highly appreciate the dissertation work, the abstract and the publications related to it and I firmly believe that the presented dissertation work meets the requirements of the ŽRASRB and the Regulations of the Agricultural University for its application. This gives me reason to evaluate it POSITIVELY and to recommend to the members of the respected Scientific Jury to also vote POSITIVELY for the awarding of the educational and scientific degree "Doctor" to Radoslava Georgieva Zaharieva in the Scientific specialty "Ecology and Ecosystem Protection", professional direction 4.3. "Biological sciences", field of higher education 4. "Natural sciences, mathematics and informatics".

22.11.2022
Plovdiv

Signature: .....
/Prof. Dr. Vasil Atanasov, DSc/