OPINION

On a dissertation for obtaining the educational and scientific degree "Doctor" in: field of higher education 4. "Natural Sciences, Mathematics and Informatics", professional field 4.4. "Earth Sciences", scientific specialty " Ecology and ecosystem conservation"

Author of the dissertation:

Radoslava Georgieva Zaharieva, regular PhD student at the Department of Agroecology and Environmental Protection, Agrarian University, Plovdiv

Topic of the dissertation:

Parasites and parasite communities of fish from the danube river – ecology and biodiversity

Reviewer:

Assoc. Prof. Dr. Penka Stancheva Zaprianova-Alexieva, Agrarian University; field of higher education 4. Natural Sciences, Mathematics and Informatics; professional field 4.4. Earth Sciences, scientific specialty Ecology and Ecosystem Conservation, appointed as a member of the scientific jury by Order No. RD-16-1118/31.10.2022 of the Rector of the University of Applied Sciences.

1. Relevance of the problem.

Most fish species participate in the life cycles of various parasites and act as their hosts. Parasites can be localized in various fish tissues and organs.

The Danube, flowing through the territory of ten European countries, contributes to the spread of a number of parasite species.

Scientific research on parasites and parasite communities of freshwater fish species from the upper reaches of the river in Bulgaria is extremely scarce, making the topic of this thesis particularly relevant.

2. Purpose, tasks, hypotheses and research methods

The aim of the dissertation is concise, precise and clear, namely: to carry out research on parasites and parasite communities of fish from the freshwater ecosystem of the Danube River. On order to realize the main objective, research work has been carried out on 5 tasks. It was quite correct to determine their sequence.

The "Materials and Methods" section is divided into 3 parts: a brief natural-geographical description of the Danube, the Danube basin and the biotopes studied; Materials; Methods.

The enormous amount of research work carried out is impressive During the period 2019-2021, 2367 specimens belonging to 8 families and 31 species of freshwater fishes were collected. The fish specimens were collected from river

Danube in the vicinity of 5 settlements Kosava, village of Kudelin, village of Kovaša, village of S. Kutovo, Kudelovo, Kudelovo, Kudelovo, Kudelovo, Kudelovo. Novo Selo and S. Yassen, Vidin district, designated as biotopes.

Basic ecological terms (parasite community structure, mean invasion density (MI), mean abundance (MA), frequency of occurrence (P%), Brillouin's diversity index (HB), Pielou's evenness index (E), Simpson's dominance index), cluster and correlation analysis were used in the statistical treatment of the data.

3. Visualization and presentation of the obtained results.

The dissertation is written in 250 pages and is well illustrated. It contains 108 tables and 75 figures. It is structured as follows: introduction - 2 pages, literature review - 31 pages, aim and objectives - 1 page, material and methods - 14 pages, results - 175 pages, summaries and conclusions - 6 pages, scientific and applied contributions - 1 page, recommendations - 1 page, references - 14 pages.

The "Results" section occupies the largest portion of the dissertation. This section includes experimental data on the biodiversity of helminth species found and the biodiversity of helminths by host. A comparative examination of the helminth communities of the studied fish species from the Danube River and of the helminth communities of the dominant fish species (abramis brama, alburnus alburnus and chondrostoma nasus) from the Kudelin biotope is performed. Results on seasonal changes of helminth communities of dominant fish species of the Danube are presented.

4. Discussion of the results and literature used.

I am impressed by the large amount of experimental work carried out in this dissertation. The discussion of the results obtained and their comparison with those of other authors shows the doctoral student's in-depth knowledge of the issues and excellent awareness. The citations in the text are correct. The cited literature sources provide sufficient scientific information.

206 literature sources were used, of which 45 in Cyrillic and 144 in Latin, and 17 online databases for the period from 1959 to 2022, with those from recent years predominating.

As a result of the analysis of the experimental results, 18 conclusions were drawn and 8 recommendations were made.

5. Contributions of the dissertation.

Scientific contributions

The scientific literature has been enriched with new information from studies on parasites and parasite communities of fishes in the freshwater ecosystem of the river Danube.

Data on the species composition of helminths of 25 fish species from the same stretch have been enriched.

New hosts for 29 helminth species have been identified for the Danube River and the river basin in Bulgaria.

The helminth communities of Ch. Nasus and updated data on the helminth communities of Alb. Alburnus and Abr. Brama from the Bulgarian section of the river Danube. For the first time, a comparison between the helminth communities of Abr. brama, Alb. alburnus and Ch. nasus and the seasonal differences in the helminth complexes of the three fish species are examined.

Applied scientific contributions

New data on the invasion rates of parasites pathogenic for the studied fish species - Sch. acheilognathi, P. laevis, Contracaecum sp., E. excisus and R. acus.

The new data obtained on the invasion rates of the human pathogenic parasites - Contracaecum sp. and E. excisus - are a prerequisite for the valuable recommendations made by the PhD student concerning the healthy consumption of fish from the studied stretch of the Danube, namely:

- Removal of the fish skin and careful inspection of the musculature (e.g. in Abr. brama, V. vimba, L. aspius, Sq. cephalus, N. fluviatilis, B. gymnotrachelus, P. fluviatilis, S. lucioperca, S. glanis), in relation to the localisation of E. excisus (species pathogenic to humans);
- Good heat treatment (e.g. Abr. brama, Alb. alburnus, Ch. nasus, V. vimba, B. sapa, C. gibelio, C. carpio, L. aspius, P. cultratus, Sc. erythophthalmus, N. melanostomus, P. fluviatilis, S. glanis) due to the possibility of the presence of Contracaecum sp. (a species pathogenic to humans);
- Small-sized fish species (e.g. Alb. alburnus, B. gymnotrachelus, N. fluviatilis, N. melanostomus, etc.) must be consumed after removal of the viscera due to the presence of intestinal parasites, some with high invasion rates;
- Strict veterinary control (Ministry of Agriculture, Bulgarian Food Safety Agency) for parasites of commercially imported fish.

6. Critical remarks and questions.

I have no critical comments and recommendations. I believe that in terms of the scope, validity and execution of the experiments and originality of the results, the proposed material significantly exceeds the requirements for obtaining the "Doctor".

7. Published articles and citations.

Publication activity of the PhD student includes 2 full text publications in WEB of Science (Q4). In both publications she is first author. Doctoral student Zaharieva has participated in 3 scientific international conferences (The proceedings of the conferences are published in WEB of Science publications).

The presented abstract is written in 32 pages and reflects objectively the structure and content of the thesis.

CONCLUSIONS:

The dissertation submitted for my opinion complies with all the requirements of the Law for the Development of Academic Staff in the Republic of Bulgaria, the Regulations for the Implementation of the Law for the Development of Academic Staff in the Republic of Bulgaria and the Regulations of the Agrarian University. I am convinced that its development has helped to build PhD student Zaharieva as an independent researcher, capable of obtaining, analyzing and presenting original scientific results. This gives me a reason to give a **POSITIVE** evaluation of the conducted research.

I take the liberty to propose to the Honorable Scientific Jury also to vote positively and to award Radoslava Georgieva Zaharieva the educational and scientific degree "Doctor" in the scientific specialty Ecology and Conservation of Ecosystems.

Date: 18.11.2022

Plovdiv

MANUFACTURED OPINION:

(Assoc. Prof. Dr. P. Zapryanova-Alexieva)