

OPINION

By Prof. Dr. Plamen Genkov Mitov,

Faculty of Biology, SU "St. Kliment Ohridski",

member of the Scientific Jury, appointed by Order of the Rector of SU No. RD-38-140/12.03.2024.

CONCERNING the thesis of Katerina Toneva Zareva-Simeonova, part-time doctoral student in the Department of Ecology and Environmental Protection at the Faculty of Biology of the University of St. Kl. Ohridski", for awarding the educational and scientific degree "Doctor" in the Higher Education Department education 4. Natural sciences, mathematics and informatics, Professional direction: 4.3. Biological sciences, scientific specialty "Ecology and conservation of ecosystems - Behavioral ecology", on the topic: "Influence of man and the environment on the behavior of selected species of mammals in closed conditions - application in zoo work and conservation", with scientific supervisor Prof. Dr. Daniela Simeonovska-Nikolova and scientific consultant: Ch. Assistant Dr. Venislava Spasova.

I. General impression of the dissertation work

The dissertation is presented in 176 pages and is structured as follows: introduction, aim and objectives, literature review, material and methods, results, discussion, research ethics, conclusions, contributions, recommendations, literature, appendices. A declaration of originality and authenticity is presented separately. The introduction very well introduces the topic of the dissertation, with several highlights in it justifying the need for such an elaboration.

Overall, the work makes a very good impression. It is written concisely, competently and clearly. The cited literary sources include 297 titles, 20 of which are in Cyrillic and 277 in Latin. They are directly related to the subject of the dissertation work. A total of 228 of the used publications were published in and after 2000. Their number shows that the doctoral student fully knows the researched problem, reflected in the modern scientific literature, which allowed to precisely define the purpose, the specific tasks and their implementation and thus to highlight the original contributions of the research conducted. The literature review gives an idea of the doctoral student's good awareness, knowledge of the problems and the ability to critically evaluate and use the existing information in the interpretation of the own data and conclusions.

The topic of Katerina Zareva-Simeonova's dissertation is related to a current research problem, with an important scientific, environmental and practical focus, related to the study of the behavior of the brown bear (*Ursus arctos*) in closed conditions, with an emphasis on stereotypical behavior, the influence of different

incentives and assessment of its level of well-being, as well as expanding knowledge about the behavior of the European ground squirrel (*Spermophilus citellus*) in zoo conditions, important in the planning and implementation of conservation activities for the species.

This undoubtedly makes the topic of the dissertation both current and dissertable, and is justified by the author through the goal set in the research and the eight main tasks related to it.

The goal and tasks are clearly formulated, the presented methodology is consistent with them, which allowed the successful completion of the dissertation work. The PhD student demonstrates good research skills in planning the study and selecting the appropriate methods and tools related to this study.

It should be emphasized right away that the topic of the dissertation work requires from the doctoral student versatile and in-depth knowledge and practical skills in various scientific directions and disciplines (zoology, ecology, ethology, zoology, conservation and statistics) and excellent knowledge of the legislative documentation on the topic. The accumulated experience and training she received during the period of obtaining her bachelor's and master's degrees, from her work at the Sofia Zoo and on a number of research projects, as well as in the development of her dissertation work, contributed to all this. to which, without a doubt, the scientific supervisor, together with the scientific consultant, have an important contribution.

II. Opinion on the significance and persuasiveness of the obtained results, interpretations and conclusions and on the nature of the scientific contributions

The results are presented clearly and are illustrated appropriately through tables, figures and graphs. On the basis of the obtained results and their discussion, the doctoral student formulates main contributions, some of which are of a scientific and some of an applied nature. It should be emphasized that the original contributions of the present work are of significant importance 1). to clarify the effectiveness of sound and smell stimuli in reducing the manifestations of stereotyped behavior in captive brown bears; 2). to improve the conditions and procedures for their rearing in closed conditions in Bulgaria by formulating recommendations for the minimum requirements and conditions for rearing the brown bear in zoos and centers for rearing and breeding protected animal species; 3). to apply appropriate forms of environmental enrichment for the brown bear in the current conditions of Bulgarian zoos; 4). for the rearing of the European ground squirrel *S. citellus* in zoo conditions and for its *ex situ* conservation.

The contributing elements of the dissertation work refer to the field of the scientific specialty in which the dissertation is. I accept the attached reference for the main contributions presented.

III. Critical notes

I have no critical remarks about the research methods used, analysis and results obtained.

But it is striking that the structure of the presented dissertation differs from that adopted for dissertation works and rather resembles that of a monographic work divided into chapters. It is not explained what is the reason for the adopted structure of the dissertation. It is more logical and clear to present all the methods used from the results in a separate chapter.

Also, logic dictates that the "*Aim and tasks*" should be positioned after the "*Introduction*" and the previous research on the topic, in this case the "*Literature review*", on which the definition of the goal and related tasks and research methods are further based.

The fact that the obtained conclusions and contributions are given very generally is also striking. All possible conclusions and contributions from the obtained results in the present study have not been sufficiently extracted and broken down. This generally damages the contribution nature of the dissertation.

The corroborative contributions are not presented, which does not allow to fully assess the contribution nature of the dissertation.

For example, the following conclusions presented by the PhD student in the discussions of:

p. 59 "...female bears, compared to males, exhibited stereotypic behavior of greater duration both before and after the presentation of both the sound and odor stimuli."

"...the olfactory stimulus 'peer urine' has value as environmental enrichment for influencing stereotypic behavior in the brown bear.

p. 71 "...the influence of zoo visitors (their numbers and behavior) can also be considered as a reason for the differences in the duration and frequency of the stereotypic behavior of the two bears in August and September."

p. 90 "...a positive correlation was demonstrated between the age of bears and hibernation ($r = 0.53161$; $p = 0.00014$). Although the relationship between the variables was weak, it appeared that young bears under 10 years of age were less likely to hibernate. What's more, those up to 20 years of age hibernate twice as often as older people."

p. 91 "...human disturbance is a significant factor affecting successful hibernation."

p. 94 "...the main problems that significantly lower the level of well-being and the quality of life of captive brown bears are the following: insufficient space, unsuitable substrate, lack of arrangement and environmental enrichment, inappropriate social structure, lack of hibernation conditions, lack of control over visitors' behavior, insufficiently complete diet and lack of fresh drinking water, lack of comprehensive and prophylactic veterinary care."

The auto-reference lacks data on the form of training; where and when the dissertation work was discussed and directed for defense. There are no data on the volume of the dissertation, the cited literature, etc. When and where the defense will take place. Composition of the jury. In addition, in the abstract, the figures and photographs are renumbered and do not correspond to the original sequence and numbering in the dissertation, as required.

However, all this does not change my opinion about the contribution nature of this dissertation work.

IV. Assessment of the quality of scientific works reflecting the dissertation research

The attached reference presents 2 collective scientific publications, in reputable refereed scientific journals: one in *Applied Animal Behavior Science* [IF 2.3 (2022), SJR 0.63 (2022), Q1 (2023)] and the other in *Acta zoologica bulgarica* [IF 0.5 (2022), SJR 0.202 (2022), Q4 (2023)]. In both publications, the PhD student is the first author. In this way, Katerina Zareva-Simeonova meets the requirements for publication activity related to the dissertation work.

In the attached reference, 4 participations of the doctoral student in international scientific forums with poster presentations, and in 3 national scientific conferences with one oral and two poster presentations are indicated. Thanks to his active participation in the mentioned conferences, the doctoral student was able to acquaint the scientific community with the results of his scientific activity on the topic of his dissertation work.

V. Recommendations

I recommend that the "*Catalogue of suitable forms of environmental enrichment for brown bears in the conditions of Bulgarian zoos*" presented in the dissertation be published in the form of a guide and distributed in Bulgarian zoos and zoocots.

Do not use the derivatives of "stereotyped behavior" such as stereotyped, stereotyping if they are not accepted in the scientific literature.

VI. Questions for the PhD student:

- Is there evidence of differences in behavioral response between bears born and raised in the zoo and those taken from the wild and subsequently reared under zoo conditions?
- How to eliminate the smell on the carton that came from the experimenter?

- For the behavioral diversity in male and female bears, determined by the Shannon index (H), there is no specified scale for interpreting the results. How are H values (p. 41, Fig. 2) interpreted and what are the cut-off values for high, medium, low index values?
- In relation to the presentation of an odor stimulus, how is the observed eating by the bears of pieces of the unscented carton, but not observed when interacting with the carton scented by a conspecific (p. 49)?
- In the "*Exploration of a new object*" test in the squirrel, what is the reason that the rubber figure used for the purpose is of a rodent and is green in color (p. 109)?
- By what criteria was the second female of the remaining squirrel selected for the exposure cage, in connection with the study of their daily and seasonal activity (p. 111)?

VII. Conclusion

The dissertation work developed by Katerina Toneva Zareva-Simeonova in terms of content, volume and structure meets the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Rules for its Implementation. The publications are in the necessary volume and reflect the results obtained in the present study. The abstract is presented in Bulgarian (58 pages) and English (52 pages), corresponds to the content of the dissertation and reflects the most important highlights of the development. Two articles have been published on the subject of the dissertation in high-quality journals, both of which Katerina Zareva-Simeonova is the first author of. The doctoral student has presented the results of her dissertation research at seven scientific forums.

Based on all the above-mentioned facts, I positively assess the quality of her dissertation and scientific publications, and I believe that she has fully fulfilled the requirements for the educational and scientific degree "Doctor", for which I will confidently vote "FOR" her award to Katerina Zareva-Simeonova for the scientific specialty "Ecology and protection of ecosystems - Behavioral ecology", field of higher education "Natural sciences, mathematics and informatics", Professional direction 4.3. Biological Sciences.

Prepared the opinion:

(Prof. Dr. Plamen Genkov Mitov)

26/05/2024

Sofia