

REVIEW

by assoc. prof. Stanislava Peicheva Peeva, PhD
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of a dissertation thesis for awarding the educational and scientific degree “*Doctor*”

field of higher education: *4. Natural sciences, mathematics and informatics*

professional area: *4.3. Biological sciences*

science major: *Ecology and ecosystem conservation*

author: *Aleksander Emilov Petrov*

topic: “A comparative study on some aspects of the ecology of the fox (*Vulpes vulpes* L., 1758) and the stone marten (*Martes foina* Erxl., 1777) in habitats of different types”

research supervisors: *assoc. prof. Ivelin Aldinov Mollov, PhD, Paisii Hilendarski University of Plovdiv, Faculty of Biology, Department “Ecology and environmental conservation” and prof. Evgeniy Georgiev Raichev, PhD, Trakia university, Faculty of Agriculture*

1. General presentation of the procedure and the doctoral student

I have been appointed as a member of a scientific jury to ensure the procedure for the defense of a dissertation according to order RD-21-2268/10.12.2024 of the Rector of Paisii Hilendarski University of Plovdiv. The topic of the dissertation is: “A comparative study on some aspects of the ecology of the fox (*Vulpes vulpes* L., 1758) and the stone marten (*Martes foina* Erxl., 1777) in habitats of different types”. The procedure concerns the awarding of a scientific and educational degree "Doctor" in the field of higher education 4. Natural sciences, mathematics and informatics, professional area 4.3. Biological Sciences, science major Ecology and Ecosystem conservation.

The author of the dissertation is Aleksander Emilov Petrov – a full-time PhD student at the Department of Ecology and environmental conservation with scientific supervisors Assoc. Prof. Ivelin Aldinov Mollov, PhD, Paisii Hilendarski University of Plovdiv, Faculty of Biology, Department of Ecology and environmental conservation and Prof. Evgeniy Georgiev Raichev, PhD, Trakia University, Faculty of Agriculture.

The candidate has submitted a set of materials, which is in accordance with Art.36 (1) of the Rules for the Development of the Academic Staff of Paisii Hilendarski University of Plovdiv:

- request to the Rector of the Paisii Hilendarski University of Plovdiv to disclose the procedure for defending a dissertation;
- European CV;
- minutes from the department council, related to reporting the readiness to open the procedure and preliminary discussion of the dissertation work;
- dissertation;
- abstract;
- list of scientific publications on the topic of the dissertation;
- copies of scientific publications;
- declaration of originality and authenticity of the attached documents

The doctoral student has applied five scientific publications related to the dissertation, three of which are published in refereed journals with **Q4**. This exceeds the required number of points, from 30 to 36 according to the Minimum National Requirements.

2. Brief biography of the doctoral student

Alexander Petrov was born in 1990. In 2020, he acquired the educational and qualification degree "Master of Ecology" in Biodiversity and Conservation at Paisii Hilendarski University of Plovdiv. In the period 2017-2021, he worked in the field of science and culture as a curator at the Regional Museum of Natural History in the city of Plovdiv. Since 2020 and currently works as a field expert for a number of foundations and organizations in connection with various environmental projects. Since 01.03.2021, he has been enrolled as a full-time doctoral student at the Department of Ecology and environmental conservation of the Faculty of Biology, Paisii Hilendarski University of Plovdiv.

3. Actuality of the topic and appropriateness of the set goals and objectives

The mechanisms of coexistence and competition between species are at the center of ecology of the communities, with particular emphasis on studying those of carnivores. Over the past 20 years, interspecific competition has been identified as a key mechanism structuring guilds of carnivores. Food, habitat, and time are considered to be the most important niche dimensions in the division of resources between species. Cohabiting species must reduce competition by switching to different diets, choosing different habitats, or changing their activity according to local environmental conditions. Thus, such research is relevant in view of populations management.

In recent years, wild animals have been increasingly pressured by human activity and, above all, by the resulting loss of habitat. For this reason, periodic research into the mechanisms of animal adaptation to changing habitats, ways of survival and coexistence in conditions of human presence is not only relevant, but also urgent.

4. Knowing of the problem

A total of 275 literary sources were used to develop the dissertation, covering knowledge about the Red fox and the Stone marten from more than 100 years ago to the present day. This demonstrates the author's attempts to inform himself with all available literature about the two predators, both in our country and around the world. As a result, Alexander Petrov was correctly setting the goal of the research with an emphasis on agricultural regions.

5. Research methodology

To achieve the goal, standard methodologies were used to determine the feeding spectrum and daily activity of mammals. Analyzing the scat content, as well as camera trapping, are non-invasive methods that have become established in ecological research in recent years and have gained great popularity. Using them allow the collection of a large volume of samples and thus, the accumulation of a significant database, but require the application of statistical analyses to prove dependencies and outline trends in the use of time, space and food base in habitats.

Standard methods were used to determine the feeding spectrum of the two studied carnivores - estimating the relative frequency of occurrence of each food item, determining the breadth of the food niche, and determining the food niches overlap. In my opinion, a weakness of the methodology is that doctoral student only worked with relative frequency of occurrence. This

method provides information about the frequency of use of each food item by the species, but has the disadvantage of treating all food items as equal and in this aspect may give precedence to some unimportant food categories. For this reason, it is always good to work with a combination of methods. For both predators, there are certain digestibility coefficients for separate food categories. Recalculating the occurrence data into a percentage of consumed biomass gives a different point of view, and in this case, a common category such as insects loses its starting positions according to the consumed biomass criterion.

In terms of statistical analyses, assessing seasonal changes in the diet of both species could be gained using a Generalized Linear Model (GLM) with subsequent application of the post hoc Tukey's test in cases of proven differences.

As for determining the daily activity of species, the text comments on results concerning twilight without providing a definition of how it is determined. Also, the entire methodology is described briefly without paying attention to the distance between the camera traps, periods for changing batteries and memory cards, heights when fixing devices on the tree trunks, selection of paths for capturing animals, etc.

Expressing the percentage distribution of recordings in selected time intervals provides information only about the activity pattern (unimodal or bimodal), but not about the animal's preferences for the period of the day for movement/activity (day, night or twilight). For a more complete analysis of the data, the percentage distribution of photos during these periods should be presented. Usually, two indices are used to analyze activity: Kernel density and capture density (D).

6. Characterization and evaluation of the dissertation work

The dissertation is written on 104 pages, including appendices and references. It contains eight main sections, the volume of which is consistent with their importance. Only the "Materials and Methods" section is critically brief – only 3 pages, with two figures included. The literature review and discussion of the results are based on a total of 275 literature sources. The doctoral student manages to come up with a clear goal with a sufficient number of tasks to achieve it. The fourth task, however, is formulated unclearly.

The author applies 3 tables and 33 figures in the main text of the dissertation to support and illustrate the applied methods and the obtained results.

A brief description of the study areas has been provided. In my opinion, it lacks an element that would guide and bind it to the two studied species, which inhabit different environments. Therefore, the characteristic stands detached from the general text.

The "Results and Discussion" section is of main importance for the dissertation. It presents in detail the material on the feeding spectrum of both species. In my opinion, most of the graphs - Figures 1 to 10 - are redundant, as they repeat the data from Table 1. Also, their title is not correct. They directly depict the RFO values of the respective foods, and do not present a comparison between them. The same applies to Figures 12 to 19. The discussion of the results on the breadth of food niches and their overlap, as well as those in the section on daily activity, is weak. A total of 11 conclusions were drawn from the study, the first of which should be discarded due to the fact that it does not provide any specific information. All the rest need serious refinement.

7. Contributions and significance of the development for science and practice

The dissertation presents new data on the feeding behavior and daily activity of the Red fox and Stone marten with an emphasis on agricultural regions. In this way, the information available to

date is supplemented and opportunities for continuing research are initiated. Of particular importance are the contributions of a confirmatory nature, but in agricultural regions in Bulgaria that have not been studied so far.

A weak point in the formulation of the contributions is that the second original contribution contradicts conclusion № 11.

8. Evaluation of the publications

Aleksander Petrov has applied five scientific publications related to the dissertation, three of which are published in refereed journals with **Q4**. This exceeds the required number of points, from 30 to 36 according to the Minimum National Requirements. Although recently published, two of the articles have a total of 5 citations

.9. Personal participation of the doctoral student

Alexander Petrov was able to conduct himself the field research, as well as process the samples in the laboratory, with subsequent participation in the determination of food items. He also personally processed all the photographic material. As evidence, some of the animals photographed during the study, were included in two Appendices. He read a large volume of literature on the problem. He actively participated in writing the sections of the dissertation.

10. Abstract

The presented abstract is 32 pages long and objectively and correctly reflects the structure and content of the dissertation work. However, I cannot help but note that the material provided to me for abstract is titled "Dissertation". It would be good if Alexander Petrov would be more careful in the future and refine his work before submitting it for review.

11. Critical remarks and recommendations

I have incorporated many of the critical comments into the analysis of the overall content and the evaluation of the criteria above. I attach some specific and concrete critical notes as an emphasis for the future work of the doctoral student:

Page 12 - "Refugia" - it is good to avoid the use of foreign words, especially in cases where they are not widely used and lead to ambiguity. In such cases, the foreign word can be inserted with the so-called... and then the meaning can be explained.

In the literature review, when citing more than one author, none of the accepted rules were followed - chronological order or alphabetical order (specifically on page 16, second paragraph, and on page 24).

The Literature Review lacks concluding paragraphs with a logical transition to connect with the remaining points. This creates a sense of disjointedness in the reader, making it difficult to read.

"Due to the significant overlap in the niches of the marten and the fox, some authors suggest that competition is possible between them.(Serafini & Lovari, 1993; Papakosta et al., 2010; Petrov et al., 2016)" – unclear statement. Overlapping of which niches – spatial, temporal, food? After all, the quote is in the point about species activity.

Page 50 and page 51 again incorrect arrangement of the cited authors.

I have the following questions for the doctoral student:

1. "For independent observation (one case), only photos separated by a 30-minute interval were accepted, as it was considered that this guaranteed the capture of different

individuals"- Why were your camera settings at 5 min. interval for subsequent shooting, if this statement is true, and not directly after 30 min?

2. How was the species differentiation of excrement performed in the spring, when samples from young foxes could be mistaken for those of adult stone martens?

3. For what reason did you not use baits to photograph the species? You state this in the methodology without justifying why.

12. Personal impressions

I am a co-author on one of the publications and overall my personal impression of working with the doctoral student in this regard is good.

13. Recommendations for future use of the dissertation contributions and results

The results of the study could be the basis for a subsequent comparison of spatiotemporal partitioning both, between the two studied species and between them and other carnivores in the area.

CONCLUSION

The presented dissertation work contains scientific, scientifically applied and applied results that represent a contribution to science and fully meet the requirements of the Law for the Development of the Academic Staff of the Republic of Bulgaria and the Regulations for the Development of the Academic Staff of Paisii Hilendarski University of Plovdiv.

They demonstrate that the doctoral student has acquired theoretical knowledge and skills for independent conducting of scientific research.

All of stated up to this point gives me the reason to confidently express my "FOR" awarding of the scientific and educational degree "Doctor" to Aleksander Emilov Petrov in the field of higher education 4. Natural sciences, mathematics and informatics, professional area 4.3. Biological Sciences, science major Ecology and Ecosystem Conservation.

25.01.2025 г.

Reviewer:

/assoc. prof. Stanislava Peeva, PhD/