

REVIEW

from Toshko Ljubomirov Toshkov, PhD
associate professor in the Institute of Biodiversity and Ecosystem Research
at the Bulgarian Academy of Sciences

of a dissertation for awarding the educational and scientific degree "doctor"
by: Field of higher education 4. Natural sciences, mathematics and informatics;
professional direction 4.3. Biological Sciences; doctoral program in Zoology

Author: Svetlozara Boyanova Kazandzhieva

Subject: Biodiversity and distribution of the families Bolitophilidae, Diadocidiidae, Ditomyiidae, Keroplatidae и Mycetophilidae (Diptera) in the Oriental region

Scientific supervisor: Prof. d. b. Mr. Dimitar Nikolaev Bechev - "PAISIY HILENDARSKI"
UNIVERSITY OF PLOVDIV

1. General description of the presented materials

By order No. PD-21-703 of March 30th 2023 of the Rector of the Plovdiv University "Paisiy Hilendarski" (PU), I have been appointed as a member of the scientific jury to ensure a procedure for the defense of a dissertation work on the topic of Biodiversity and distribution of the families of Bolitophilidae, Diadocidiidae, Ditomyiidae, Keroplatidae and Mycetophilidae (Diptera) in the Oriental Region for the acquisition of the educational and scientific degree "doctor" in the field of higher education 4. Natural sciences, mathematics and informatics; professional direction 4.3. Biological Sciences; doctoral program in Zoology. The author of the dissertation is Svetlozara Boyanova Kazandzhieva - a full-time doctoral student at the Department of Zoology with supervisor Prof. Dimitar Bechev from Paisii Hilendarski University of Plovdiv.

The set of electronic materials presented by the aforementioned PhD student is partially in accordance with Article 36, Paragraph 1 (amended on October 15th 2018) of the Regulations for the Development of the Academic Staff of the PU. The set includes the following documents: 1. Request to the Rector of the PU to disclose the procedure for the defense of a dissertation work; 2. CV in European format; 3. Protocol of the preliminary discussion in the department of the dissertation work in the department /in the form of a transcript, with many gaps in the coverage of the questions asked and the subsequent discussion/; 4. Abstracts of the work in a volume of 32 pages in Bulgarian and in English; 5. Declaration of originality and authenticity of the attached documents signed by the doctoral student on

March 13th 2023; 6. Dissertation work; 7. Certificate of compliance with the minimum national requirements signed by the doctoral student and supported by the signatures of the head of the department of Zoology and the dean of the Faculty of Biology without a specified date of issue; 8. List of scientific publications on the topic of the dissertation signed by the doctoral candidate on March 13, 2023; 9. Copies of two scientific publications that match the titles reflected in the document under point 8.

The presented documents are correct and contain evidentiary materials regarding their content supported by signatures of the relevant responsible persons; the documents do not overlap in content and subject matter.

The following documents are missing in electronic form: diploma for higher education in educational-qualification degree "MSc" with appendix; recod from the faculty council on the candidate's readiness for preliminary discussion.

2. Brief biographical data of the PhD student

According to the presented autobiography, Svetlozara Kazandzhieva completed a master's course in Ecology and Conservation at the same scientific institution in the period October 2015 - October 2017. The course is completed with the presentation of a diploma thesis on the topic "Distribution of higher freshwater crayfishes (Crustacea: Decapoda) in Bulgaria". The "Biodiversity, Ecology and Conservation" specialty covered by the master's degree provides the theoretical basis for the realization of research on the chosen topic of the dissertation work. Mrs. Kazandzhieva also had a sixty-six-month training during the period September 2017 to date at the Regional Museum of Natural History in Plovdiv as a "Public Relations" a sa specialist and tour guide, where she additionally acquired professional skills indirectly related to the development of the dissertation. For the period September 2011 to the present moment, Svetlozara Kazandzhieva has indicated a number of assets /including obtaining a bachelor's degree/, which I do not mention in this review, as they have no direct connection with the realization of the work on the dissertation.

3. Relevance of the topic and appropriateness of the set goals and tasks

The relevance of the problem developed in the dissertation is reduced to two main aspects: 1. The area where the research was conducted and 2. The group of organisms, the object of the research. The area of research - the Oriental zoogeographic Region /represented as including the Indian subcontinent, Sri Lanka, southern China, mainland Southeast Asia, the Greater and Lesser Sunda Islands and the Philippine Archipelago/ is a place of extraordinary biodiversity and complex relationships of penetration of flora and fauna in the northern and /especially emblematic/ in its southeastern part. Many groups of vertebrates and invertebrates have been studied in this area, registering a high degree of endemism and

unique faunal features. Among insects, the best-studied group at the level of order in the region is the Lepidoptera, while, in contrast to the other three "Large" orders, Diptera are the least studied. Within this group, the Fungus Gnats of the families Bolitophilidae, Diadocidiidae, Ditomyiidae, Keroplatidae and Mycetophilidae are still poorly studied as a whole, and the combination of the two circumstances region/organism group shows how many new and original contributions can be made to the subject. Weak taxonomic study in general, leading inevitably to weak faunal study at the local level, predisposes to the discovery of new taxa in the first place in the species and genus groups. The set goal, to clarify the species diversity and zoogeographical features of the mycetophylloid fauna of the region on the basis of faunal and taxonomic studies, related to the summarization of all previous data, fully corresponds to the topic and is in the service of solving "on the spot" of current problems in this group of insects.

4. Competence with the problem

Svetlozara Kazandzhieva demonstrates profound knowledge of the problem of scientific research, which is evident from the skillful use of information from reference sources for the presentation of the group, from the in-depth analysis of information from previous studies on the group from the region and from the choice of approach for presenting the known until now information on the subject. These skills are traceable in the introductory 1. to 4. chapter of the dissertation. Of particular interest here is the detailed review /in chapter 2./ of the development of research and the accumulation of knowledge on the mycetophyllid fauna of the region in a historical aspect. The overview was made by periods, in several ones, and the contributions of the respective authors were evaluated in terms of the number of known taxa and the number of investigated sites; unequivocally is highlighted the progress in the knowledge of fungus gnats in the last 20 years. The overview part "Brief physical-geographical data for the studied region" introduces the reader to some features of the individual "sub-regions" of the Oriental region. It is made tight, within the necessary minimum.

5. Research methodology

The chosen research methodology allows in principle to achieve the set goal and provides an adequate answer to the tasks solved in the dissertation work. The methods of obtaining material and its subsequent processing are suitable to provide a sample of value sufficient to be objectively interpreted in terms of real results and conclusions. The originally acquired material and the studied material from other museums/collections/ is from a very narrow range applied to the entire territory of the Oriental Region, but it is from representative places and is sufficient to provide a basis for achieving the goal set by the doctoral student.

6. Characterization and evaluation of the dissertation work

The dissertation is written on 264 self-numbered pages and includes one unnumbered page with a "Declaration" on behalf of the PhD student, 9 tables, 71 figures, one appendix in text&table format and three appendices in table format. It is structured in 10 main chapters and appendices immediately added, respectively: 1. Introduction; 2. Previous studies of Fungus Gnats in the Oriental region; 3. Purpose and tasks of the research; 4. Brief physical-geographical data; 5. Material and methods; 6. Results and Discussion; 7. Summarized results; 8. Conclusions; 9. Contributions; 10. References.

-1. Introduction. In the introductory chapter, the doctoral student presents the studied group, including five families from the superfamily Sciaroidea; here you can see the impressive number of described taxa from the species group for the five families – over 5700 for the world fauna; a brief outline of the general distribution and biological features of Sciaroidea is also made. Within one page, the motivation for the study and the relevance of the problem of a scientific nature are presented in a concise and orderly form. Finally, an overview of the morphological features of the imaginal form is provided here, supported by 4 suitable illustrations, which is at the service of the reader in the review and analysis of the manuscript in part 6.

-2. Previous studies of Fungus Gnats in the Oriental region. The present chapter of the dissertation, occupying a total volume of 6 pages, presents information on the five families of sciaroides regarding their study in a historical aspect from the Oriental region. An analysis of the literature and publications on the group from the region for the period 1848 - 2022 was made, quoting more than 140 sources, correctly indicated in the list of used literature. This required element of the present study is further explained by presenting research developments by periods in the nineteenth, twentieth and twenty-first centuries, respectively.

-3. Purpose and tasks of the research. The purpose of the research - clarification of the species diversity and zoogeographical features of the mycetophyllid fauna in the Oriental Region is clearly formulated, and for its achievement, seven separate tasks are presented with reason; the specific tasks to achieve the goal are appropriately chosen, except for the last two, which are beyond the scope of the research objective.

-4. Brief physical-geographical data. In the present section, occupying 6 pages and illustrated with five figures, information on borders, relief, climate and habitats in the Oriental Region is presented in a synthesized form. The data presented here cover the minimum necessary information to provide a basis for the development and assertions in Sections 6 and 7.

-5. Material and methods. The material for the present study was collected from 4 countries /Indonesia, China, Malaysia and Thailand/, and part of it was collected personally by the doctoral student. The methodical approach to the analysis of the previous reports is well presented and allows a complete and adequate reference to be made for the species of the group for the area. The laboratory methods and the methods related to the analysis of faunal and ecological data are well chosen. In addition,

a number of data regarding the subdistricts of the Oriental Region, the borders in detail and the treatment of some outdated toponyms are indicated, related to a correct analysis of the literature before 1950.

-6. Results and Discussion. Here, the results of the work are presented in four subsections. Subsection "Taxonomic part" is the essential part of the thesis, where 2 species new to science, *Chetoneura lagangensis* and *Stenophragma borneense*, are described only by male sex and excellently illustrated. In addition, two other, practically new to science species of the genera *Monoclona* and *Acnemia* are described in this part, but without attributed specific names. The PhD student correctly approached the treatment of eight other species, within two genera, which she recognizes as "problematic" on the basis that they cannot be determined at the present stage. The subsection end with the presentation of determination keys for the species of the genera *Chetoneura* and *Stenophragma*, in which they are both newly described species, and a discussion of nomenclatural problems in the families Keroplatidae and Mycetophilidae. The second subsection "Faunistic part" is the largest part of the dissertation, covering 149 pages. It presents (in check list shape) the families, genera and species of Sciaroidea from the Oriental Region, and the genera are accompanied by a map of their global range, valid name, place of first description and information on the type species of the genus; listed species are attributed as follows: valid name, place of first description, sex, type locality, known localities, and general distribution. The list is precisely made and the information it contains is at the service of data analysis. The third subsection deals with elements of the taxonomic structure of the sciaroid fauna of the Oriental Region, in particular the degree of study and structure of the fauna at the family, subfamily and generic levels. It is done correctly and the data is interpreted adequately. The last subsection concerns elements of a zoogeographical nature with presented summary data regarding the number of genera of the group closely related to the Oriental Region, the number of wide-ranging species and the number of species by subregion. The information here is well presented in a reader-friendly format.

-7. Summarized results. The summarized results are grouped into 7 paragraphs and logically follow the results of the previous chapter, being presented in a synthesized form. Most results are related to the account and categorization of the sciaroidean fauna within the Oriental Region.

-8. Conclusions. On the basis of the summarized results and the background of the previous studies on the object of the present study, 10 conclusions were drawn. Four of them can actually be qualified as such, they reflect: that the review of the data on the fungus gnats of the Oriental Region indicates that the fauna is poorly studied compared to that of the Palaearctic and is comparable to the fauna of the Afrotropics and Australasia-Oceania; that compared to the other regions, the Oriental Region has a significant amount of endemic genera /especially compared to the Holarctic/; Oriental Region is closer to Holarctic and Palearctic; at present, the zoogeographical analysis of the distribution of the species in the subregions of the Oriental region is difficult due to insufficient data. The remaining six

"conclusions" (NN. 1, 3, 4, 5, 6, and 7) reflect just results, rather than providing a basis for scientific conclusions.

-9. Contributions. The contributions in the dissertation are clearly outlined and presented in two separate groups. 1/ Contributions of an original scientific nature: they are derived from the summarized results and are eleven in total; I cannot agree that contribution number 8 is real, as far as the synonymy data for all genera are taken from previous publications, the generalization itself cannot be considered as a personal contribution of the doctoral student. 2/ A modified scheme for the systematization of the geographical distribution of taxa in the Oriental region was developed based on an existing scheme for the distribution of plants.

-10. References. The quoted literature covers three network-based databases and 269 literary sources, of which in Bulgarian /1/, in Russian /8/, in English /234/, in French /2/, in Polish /1/, in German /10/, in Chinese /3/. The wide range of literature used is impressive, which undoubtedly provides a real basis for evaluating and presenting the author's original research. Most literary sources are correctly presented in the reference literature list, and all of them are reflected with their references in the main text of the dissertation and are interpreted in the text part correctly. Zaitsev's works from 1982 and 1994 should be cited in Russian as published.

Appendices. Three appendices are included with the text of the dissertation, two in table format and one in text&table format. They reflect details about the number of families, subfamilies, genera and species, their distribution by subregions and zoogeographical typification in several ways.

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

The contributions in the dissertation are mainly of a scientific nature. The most significant original contributions are confined in presenting for the first time the history of research on Fungus Gnats from the Oriental region; the establishment of two species new to science and the differentiation of two more, which alone should receive a species name in a future publication, and the preparation of keys for the determination of species within two genera. In a practical aspect with a scientific-applied character, a modified scheme for the systematization of the geographical distribution of sciaroides in the Oriental Region has been prepared.

8. Assessment of publications related to the dissertation

Two out-of-print publications are presented on the dissertation work. The two published publications are in the form of articles written in English and are co-authored by the PhD student's scientific supervisor. They were published by the prestige journal *Zootaxa* in 2020 and 2022 respectively. The publications are at a high scientific level and reflect part of the results of the dissertation related to the description of the two species new to science.

9. Personal participation of the PhD student

The scientific contributions of the PhD student have an original character, reflect the obtained results, and I undoubtedly accept them as a personal merit of Svetlozara Kazandzhieva.

10. Abstract

The abstracts in Bulgarian and English occupy a volume of 32 pages each; they are prepared in accordance with the requirements for such and their content fully reflects the results of the dissertation, presenting the most essential moments in it in the form of identically copied particular parts of main results and abbreviated subsection "Faunistic part" in the form of an example. An abbreviated list of references to 57 literary sources is presented.

11. Critical remarks and recommendations

I have the following critical notes on the work with questions and recommendations arising from them.

Under the subsection "First summary information in catalogs until the end of the nineteenth century", the PhD student cites the island of "Waigoe" of the Australian Region. An island with such a name does not exist. Hence the question of whether she is using an old name /not listed on page 32 of the thesis/ or is there an accidental letter-swapping error for Waigeo Island?

In the section "Brief physico-geographical data for the studied area" /and in several other places in the dissertation - for example in Table 3/ the PhD student defines subdivisions in the Oriental Region "Indochina" and "Malay Archipelago". Obviously, the system according to the cited literary source /Prokhorov, 1972/ was directly followed here. Unsuccessful here is the grouping (apparently on a historical or political principle) of subdivisions such as "Indochina" and "Malaysia". Such a grouping can only serve to facilitate the analysis of previous reports on the studied group at the local level, but it is better to divide it into subdivisions into continental Southeast Asia /respectively with parts of the countries of China and Malaysia, with Thailand, Singapore, Cambodia, Myanmar, Laos and Vietnam/ and

Greater /Sumatra, Java, Borneo, Sulawesi/ and Lesser /Sumbawa, Flores, Timor/ Sunda Islands, which better reflects geographical isolations and fauna formation in the near geological past. This is also in the service of the interpretation of the results of a zoogeographical nature, bearing in mind, for example, that the PhD student accepts Weber's line as the southeastern border of the Oriental Region, closely related to the position of the Greater and Lesser Sunda Islands.

In the subsection "Taxonomic part" two species of the genera *Monoclona* and *Acnemia* are given with full and correct descriptions and differential diagnoses, but not named. What made the PhD student refrain from actually describing a new taxon in this case? Maybe the fact that they are not given in a publication? As a consequence, the question arises, does she intend to publish these species as new in the future?

In the subsection "Identified nomenclatural problems" the term "ОМОНИМИ" is used. In the case of the Bulgarian language, this refers to words that are written and pronounced in the same way. In the International Code of Zoological Nomenclature, the original is "homonym". I recommend using the transliterated "ХОМОНИМ" in texts in Bulgarian, at least in order to make clear that it refers to a specific term from the Code. In this connection, a question arises. Does the PhD student intend to publish this synonymy in the future, and if she intends to do so, what new names for these taxa would she propose?

12. Personal impressions

I know Mrs. Kazandzhieva only from the meeting on approval of the dissertation and work. During this event, I was impressed by the depth and knowledge of the Diptera group that she study and the ability to pose and analyze scientific problems on a theoretical basis.

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

As specific recommendations, first of all, I draw attention to publish the two new species of the genera *Monoclona* and *Acnemia* as soon as possible, and also not to allow the established synonymy of the six species, treated in subsection "Identified nomenclatural problems" to be "archived" only in the dissertation.

CONCLUSION

In conclusion, I declare that the dissertation submitted for review is an independent and significant scientific labour, which is based on a satisfactory volume of material and which contains original contributions. The dissertation contains scientific and scientific-applied results that represent an original contribution to science and meet all the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation and the relevant Regulations of PU "Paisiy Hilendarski". The dissertation shows that the PhD student has profound

theoretical knowledge and professional skills in the scientific specialty of Zoology, convincingly demonstrating the qualities and ability to conduct and complete scientific research.

Due to the above, I give my positive assessment of the conducted research, presented in the dissertation work, the abstract, the achieved results and contributions, and I propose to the respected scientific jury to award the educational and scientific degree "doctor" to Svetlozara Boyanova Kazandzhieva in the field of higher education 4 Natural sciences, mathematics and informatics, professional direction 4.3. Biological Sciences, Doctoral Program Zoology.

20 April 2023 г.

Reviewer:

Assoc. prof. Toshko Ljubomirov, PhD