Вх.№ ИОХЦФ-370/24.06.2022 г.

OPINION

by Assoc. Prof. Milena Nikolova, PhD, Institute of Biodiversity and Ecosystem Research, BAS

on the PhD Thesis for awarding the educational and scientific degree "Doctor" in the field of higher education: 4. "Natural Sciences, Mathematics and Informatics", professional direction 4.2. "Chemical Sciences", scientific specialty: Bioorganic chemistry, chemistry of natural and physiologically active substances "

Author: Victoriya Svetlinova Ivanova
Topic: Phytochemical characterization of species of genus *Inula* growing in Bulgaria

Supervisor: Prof. Antoaneta Trendafilova, PhD
Scientific consultant: Assoc. Prof. Milka Todorova, PhD

1. **General presentation of the procedure and the PhD student**

The submitted materials from Victoriya Ivanova for the award of the educational and scientific degree "Doctor" are in accordance with the legal requirements. The candidate meets the national minimum requirements for the acquisition of degree "Doctor" and even exceeds them repeatedly.

2. **Importance of the theme**

The study of natural products is important direction in science, which is in accordance with the National Strategy for the Development of Research in the Republic of Bulgaria, 2017-2030. The weak phytochemical study of the species of the *Inula* genus spread in Bulgaria determines the need to develop such a topic.

3. **Knowing the problem**

The literary review shows the good theoretical preparation of the doctoral student. The available data on the reported sesquiterpene lactones and flavonoids in the target species are systematized. Basic approaches and methods for extracting, fractionation and isolation of substances from plant material are presented, as well as for their identification by applying modern methods of analysis. Methods for evaluating the antioxidant potential of extracts are described.

4. **Methodology**

In the "Experimental Part" section, the approaches and methods used are adequately selected to accomplish the tasks and also they are exhaustively and in detail described. Classic and modern methods for quantitative and qualitative analysis of sesquiterpene lactones and flavonoids are applied, as well as for determining the antioxidant potential of the extracts.

5. **Characteristics and evaluation of dissertation and contributions**

In the "Own Researches" section, the results of the phytochemical analysis of the three *Inula* species are presented exhaustively, and they are clearly, in details described, supported by appropriate figures and tables. It is understood from the descriptions that the doctoral student has learned and skillfully copes with the technical part for receiving, fragmentation and isolation of substances of plant material, but also with the analysis and interpretation of spectra to identify them. The comparative analysis of the chemical composition of the investigated species *Inula* in the context of the data already reported in the literature shows the analysis and discussion skills.

The comments presented on chemical diversity in the species studied, the interspecific relationships and the chemotaxonomic conclusions drawn to an interdisciplinary thinking and knowledge that go beyond pure organic chemistry. The comparative qualitative and quantitative analysis of *I. britannica* extracts, obtained from different localities of the species, demonstrates the possibility of selection of promising populations, which is of scientific applied meaning. The antioxidant potential and the content of phenolic compounds in extracts from different organs and the origin of the three *Inula* species have been comparatively evaluated. The results of studies on the topic of the dissertation are grouped into 12 conclusions and 7 contributions. The latter are significant and original - 9 new substances are isolated; a new chemotype of *I. britannica* has been identified; new data on the antioxidant potential of extracts of leaves and flower heads of *I. britannica, I. oculus-christi u I. aschersoniana* var. *aschersoniana* have been identified. A promising population of *I. britannica,* rich in target components - sesquiterpene lactones and phenolic compounds, has been selected.

6. Assessment of publications and personal contribution of the PhD student

The results are presented in 6 publications indexed in WoS and Scopus. The distribution of quartile articles is as follows: one in Q1, three in Q2 and two in Q4. The doctoral student is the first author of three of the publications. 16 quotes have been noted. The data presented show the importance and relevance of the results of the dissertation in world science. Some of the results are presented at 7 international scientific forums.

7. Autoreferat

The autoreferat is informative and correctly reflected in a shortened form the content of the main sections of the dissertation.

CONCLUSION

The dissertation work of Victoria Ivanova represents comprehensive and important phytochemical study of three species of the *Inula* genus growing in Bulgaria. The scientific and scientific applied results are an original contribution to the science and meet all the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria, the Regulations for the Implementation of the Law on the Law and the respective Rules of IOCCP-BAS.

The dissertation shows that the doctoral student has the necessary theoretical training, practical skills and professional capacity to conduct independent research in the scientific specialty "Bioorganic chemistry, chemistry of natural and physiologically active substances" Due to the foregoing, I am confidently **giving my positive assessment** of the study and I offer the revered scientific jury to award the educational and scientific PhD degree of **Victoriya Ivanova** in in the field of higher education: "Natural Sciences, Mathematics and Informatics", professional direction: „Chemical sciences“, scientific specialty: „Bioorganic chemistry, chemistry of natural and physiologically active substances. "

24.06.2022. Prepared the opinion:

..... …… ..... (Assoc. Prof. Dr. Milena Nikolova)