

Review of the doctoral dissertation of MSc. Kavana Raj „Developmental and agrotechnical factors influencing the yield and quality of valerian raw material”.

The review was prepared based on Resolution No. 37/RiO-2025/2026 of the Disciplinary Council for Agriculture and Horticulture of the Warsaw University of Life Sciences of April 9, 2026.

The PhD thesis has been conducted in Department of Vegetable and Medicinal Plants, Institute of Horticultural Sciences, Warsaw University of Life Sciences under the supervision of Prof. dr hab. Katarzyna Bączek and assistant supervisor Dr. Jarosław L. Przybył.

The dissertation was prepared based on two publications from four field experiments, the results of which were published as co-authored, but in both cases the PhD student was the first author. Her significant contribution to the creation of both publications is confirmed in Chapter 10: Co-authorship statements of the publications.

The doctoral dissertation submitted for review is an original synthetic study prepared based on two thematically related and published scientific works (an article in a journal and a chapter in a monograph):

1. Raj, K., Węglarz, Z., Przybył, J., Kosakowska, O., Pawełczak, A., Gontar, Ł., Puchta-Jasińska, M., Bączek, K. (2024). Chemical diversity of valerian (*Valeriana officinalis* L. s.l.) wild-growing and cultivated, originating from Poland. *Molecules*, 29(1):112. <https://doi.org/10.3390/molecules29010112>.
2. Raj K., Węglarz Z., Przybył J.L., Kosakowska O., Jędrzejuk A., Pawełczak A., Gontar Ł., El-Ansari M., Bączek K. (2025). Environmental and developmental aspects of the accumulation of terpenes in common valerian (*Valeriana officinalis* L.), in: K.G. Ramawat et J.-M. Mérillon (eds.). *Natural Products: Phytochemistry, Botany and Metabolism of Alkaloids, Phenolics, Terpenes* (ID:239) Springer Nature. https://doi.org/10.1007/978-3-642-36202-6_239-1.

Valerian is one of the most important medicinal plants, and Poland is a significant producer of this herbal raw material. Moreover, demand for valerian root has been increasing in recent years. Therefore, research aimed at expanding knowledge about the previously unrecognized requirements of this species, its properties, including the content of active substances, is necessary to improve genotypes and production technologies. This is currently a condition for maintaining a competitive position in the demanding global herbal market. The subject matter and scope of the work submitted for review fit perfectly into this trend.



Assessment of individual chapters of the Author's work

Title of the dissertation „Developmental and agrotechnical factors influencing the yield and quality of valerian raw material” accurately reflects the content of both publications and the author's study.

Introduction

In the Introduction, the PhD student highlighted the importance of valerian in both historical and contemporary terms, at the same time pointing out areas where scientific data are scarce. In the final paragraph, she listed four research objectives, which were then repeated in Chapter 3.

Literature

The literature review covers all relevant information on valerian, including taxonomy, historical and geographical importance, plant development, cultivation methods and post-harvest treatment, quality of the raw material and products based on it. The author provides a lot of information supported by carefully selected literature, and the text is written in a concise, orderly, and unambiguous manner. Additionally, 16 original photographs have been included. This makes this chapter an engaging read. It can serve as an example of how to professionally prepare a Literature review.

Based on the data from the literature, four research hypotheses were formulated, and four detailed research objectives were specified, which were to lead to the confirmation and/or specification of the assumptions set out in the research hypotheses. In my opinion, however, the third hypothesis is too general and obvious.

Materials and research methods

The results presented in the dissertation were obtained from four experiments conducted in field, greenhouse and laboratory conditions in 2021-2024.

The objects of the first experiment were 10 populations of wild-growing valerian and 4 forms of 'Lubelski' landrace. The author reports that the first stage of the research concerned only the evaluation of chemical variability both within and between wild-growing valerian populations and cultivated forms of 'Lubelski'. This is imprecise in relation to assumptions given in the first hypothesis, where “the mass of underground organs” was mentioned. The yield level is described in the chapter on research results and, importantly, constitutes a very important conclusion (No. 2).

The aim of the second experiment was to assess the chemical variability of valerian underground organs, accounting for differences in their structure. The research material came from experiment 3, the "one-and-a-half-year cycle" version. The question arises as to why the annual crop version was not included.

The aim of the third experiment was to compare the yield and quality of valerian raw materials obtained from two cultivation methods commonly used in Polish agricultural practice: a one-year and a one-and-a-half-year cultivation cycle.

The aim of the fourth experiment was to assess the effect of the removal of bolters on the yield and quality of valerian underground organs.

There is no clear information about the years in which individual experiments were carried out. It is a pity that the author did not provide the years in which each experiment was conducted. I assume that the first experiment was conducted in 2022, because the weather data for that year are given in the original publication (Rai et al. 2024). Based on the table with weather data (Table 3 p. 35) it can be assumed that the third and probably the fourth experiment were not single-year experiments and were repeated in the following year (or years?).



All other information on field test methods, soil and climatic conditions, chemical analyses and statistical analyses is sufficient. Of particular note are the excellent photographs reflecting the individual stages of plant development and harvesting. This is a really valuable addition to the description of research methods included in the original publication. All field experiment results are supported by in-depth analyses of active ingredient content, which demonstrates the significant scientific and practical value of the research conducted.

One technical note regarding the nomenclature: the correct name for the voivodeship mentioned in this work is „Kuyavian-Pomeranian Voivodeship”

Results and Discussion

In this chapter, the Author focused on the most important research results obtained and compared them with previous publications in a very professional manner. The selection of literature for discussion and the method of comparison with your own results are appropriate. However, the Results and Discussion section is also a place where you can add your own opinion. Regarding the first experiment, the PhD student expressed an opinion with which I completely agree - “These findings suggest significant potential for breeding programs focused on improving yield and chemical traits, which are taken into account during raw material standardization”.

In the case of the second experiment, the PhD student's suggestion that “thin roots contributed substantially to total biomass and were found to be a valuable source of biologically active compounds, making them a material with significant utility potential” requires explanation. I believe that theoretically the Author is right, but practically, these thin roots are difficult to obtain.

With regard to the third experiment, I did not find any explanation in the text of the study why farmers use both methods of valerian cultivation, i.e. one-year and one-and-a-half-year cultivation, if it is known, as clearly confirmed by the research results presented here, that the yields of raw material from one-and-a-half-year cultivation are significantly higher.

The results of the fourth experiment prove that the retention of bolters leads to a distinct decrease in the mass of underground organs with higher content of EOs, whereas the content of sesquiterpenic acids remains rather stable and the removal of bolters influences the composition of root EO”. It is worth emphasizing that such information about valerian has been described here for the first time in the scientific literature.

Conclusions

The content and manner of formulating the conclusions raise no doubts. All conclusions clearly reflect the obtained study results.

Bibliography:

This study was prepared based on 102 well-selected references and two publications that formed the basis of this doctoral dissertation.

Reviewer's Summary

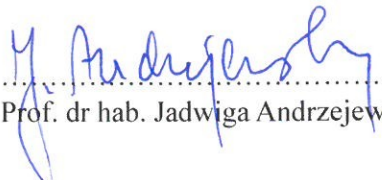
The subject matter is timely and economically important, primarily due to the current and future importance of valerian. I consider the ability to present information in a concise, clear, and unambiguous manner to be an unquestionable asset of this work. The work provides a range of new data that is worth using in further research and development.

During your doctoral defense, please address the issues underlined in the text of my review.

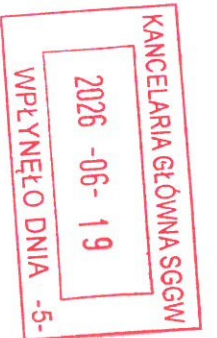


FINAL CONCLUSION

Based on the above I conclude that the doctoral dissertation meets the requirements specified in Article 187, paragraphs 1-4 of the Act of July 20, 2018, The Law on Higher Education and Science (Journal of Laws of 2018, item 1668, as amended). Therefore, I propose to the Disciplinary Council for Agriculture and Horticulture of the Warsaw University of Life Sciences to admit the doctoral candidate to the next stages of the doctoral procedure.


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