

REVIEW

of the official reviewer Halyna Zhatova
for the dissertation of

He Songtao

**«Complex ecological, physiological and genetic analysis of the response of
Cucurbita genus representatives to salt stress»,**

submitted for a Doctor Philosophy Degree (PhD)

Field of study: 10 – Natural Sciences

Specialty: 101 – Ecology

Relevance of the dissertation topic. Nowadays about 20% of the world's arable lands are subject to salinization. At the background of global climate changes, their area is constantly expanded. Soil salinization leads to the loss of up to 50% yield. As a result, salinization becomes one of the powerful factors limiting the sustainable development and modernization of world agriculture. Studies aimed at elucidating the mechanisms of response and adaptation of plant organisms to salt stress are becoming more and more important. The research covers the agricultural crops, representatives of the *Cucurbitaceae* family, which are widely cultivated in the world due to its economic, medicinal, edible and ecological values. *Cucurbitaceae* are not halophytes, most of them are sensitive to salt stress. The issue of clarifying the ecological-physiological, genetic aspects of the response to salt stress of representatives of the *Cucurbitaceae* family and the genus *Cucurbita*, the formation of their salt resistance, becomes relevant and managing this trait on the basis of the use of both classical and modern scientific and technical means. Research has significant theoretical and practical significance, because it allows to deepen knowledge about the essence of the life phenomena, about the role of different levels of the organization in ensuring plant response to the influence of internal and external factors, to determine the possibility and approaches of managing adaptation processes and, on this basis, for areas, that have undergone salinization, to develop conceptual principles for the formation of sustainable and productive agrocenoses with the participation of the *Cucurbitaceae* family, including its typical representative: genus *Cucurbita* (pumpkin).

Connection of the research with scientific programmes, plans, and topics. The research work was carried out according to the tasks of the thematic plans and within the framework of the state scientific topics of the Sumy National Agrarian University (Department of Ecology and Botany) and according to the plans of the research institute work of Henan University of Science and Technology. In particular, research was supported by grants from the Key Research and Promotion Projects of Henan Province (No.212102110410 & No. 202102110202).

The scientific novelty of the obtained results. For the first time the influence of salt stress on a complex of quantitative and qualitative morphological characteristics of pumpkin plants was studied. The features and regularities of the accumulation of ions of mineral substances in the vegetative and generative organs of pumpkins under conditions of salt stress have been established. Physiological and biochemical transformations that appear in pumpkins against the background of salt stress were comprehensively investigated and clarified. There have been screened 12 WRKY family transcription factors in pumpkin in response to salt stress, and analysed their phylogenetic relationships, spatio-temporal expression patterns, tissue-specific expression characteristics, and transcriptional activities under salt stress in detail. For the first time, the eco-physiological interactions and transformations that occur during the cultivation of *Cucurbitaceae* using grafting technology and the use of arbuscular mycorrhizal fungi were investigated and clarified. The methodological aspects of the assessment of salt stress impact assessment during ontogenesis of pumpkin have been improved and the technique of vitality analysis was used to assess the condition of pumpkin plants. The efficient transient transformation system for the study of gene function and protein subcellular localization in pumpkin have been developed. The further development of the theoretical and practical principles of the use of salt-tolerant pumpkin rootstock for cultivation of watermelon have been gained.

The practical significance of the obtained results. The materials of the dissertation were covered in scientific publications and included in the curricula of

the specialties of 101 Ecology at the Sumy National Agrarian University (subjects: “Ecological Physiology of plants”, “Agroecology”, “Biology”).

The main results obtained personally by the author. The dissertation provides a theoretical generalization and a new solution to the scientific problem of stabilizing the impact of stress factors of *Cucurbita pepo L.* The applicant conducted complex studies on the influence of salt stress on the morpho-structure and habit of pumpkin individuals as well as their vitality. The impact of salt stress on indicators related to the photosynthesis process and water exchange, the peculiarities and regularities of the metabolism of main organic substances in the pumpkin plant were established. It has been found out the varietal differences (between Yanzhen and Miben cultivars) in response to salt stress and their adaptation to it at all levels of the organization. In particular, it was established that the Yanzhen mainly accumulates Na^+ in the root system, while the Miben mainly accumulates in the stem. The WRKY gene family and analyze its expression in response to salt stress in pumpkin was identified. For the first time analysis of the expression of the WRKY gene family in pumpkin under salt stress conditions was carried out and WRKY family transcription factors in response to salt stress were screened, and analyzed their phylogenetic relationships, spatio-temporal expression patterns, tissue-specific expression characteristics and transcriptional activities in detail. Characteristics of mycorrhizal fungi use in the cultivation of melon crops based on grafting technology in change in plant metabolism, the quality of the obtained products and increasing the resistance of plants to adverse environmental factors were determined.

An analysis of the plagiarism check report for the presence of textual borrowings (Strike Plagiarisma Program) was carried out, which proved that He Songtao на тему «Complex ecological, physiological and genetic analysis of the response of *Cucurbita* genus representatives to salt stress» is the result of independent research of the applicant and does not contain elements of plagiarism and borrowing in accordance with the resolution of the Cabinet of Ministres of Ukraine dated

12.01.2022 No. 44, paragraph 9. The used ideas, results and texts of other authors have a link to the corresponding source.

Number of scientific publications. The main items of the thesis are presented in 12 scientific works: 3 articles were published in a scientific journal, included in the database of Scopus, Web of Science, 3 articles were published in professional scientific journals of Ukraine, 6 - abstracts of reports at international scientific and practical conferences.

Remarks for the thesis content. Positively evaluating He Songtao's dissertation work, its important scientific-theoretical and practical significance, novelty and relevance of research, it is appropriate to make the following comments and wishes.

1. When studying the changes that occur in pumpkin plants under salt stress during the growing season, it was appropriate to use the ontogenesis periodization scale of BBCH

2. It is desirable to give a more detailed description of the Yanzhen and Miben varieties

3. It would be appropriate to present the research results not in only one Chapter 3, but in several separate Chapters according to the directions of the research, for example:

“Genetic aspects of adaptation and response of pumpkins to salt stress...

“Eco-physiological aspects of use mycorrhizal fungi”.....

3. There are inaccuracies in the design of the work :

the words "table", "appendix" according to the requirements are placed in the right corner but not in the line with the title; (Figure or Fig.); lack of points in the title of subsections and so on.

Correspondence of the dissertation to the specialty and the profile of the specialized academic council. Dissertation by He Songtao «Complex ecological, physiological and genetic analysis of the response of *Cucurbita* genus representatives to salt stress», which was submitted for defense to the specialized academic council for the degree of Doctor of Philosophy in the field of knowledge

Field of study: 10 – Natural Sciences, Specialty: 101 – Ecology in terms of relevance, scientific and theoretical level, main results of validity, provisions and results published in professional publications, novelty of the formulation and practical significance meets the requirements of the order Ministry of Education and Science of Ukraine No. 40, January 12, 2017 "On approval of requirements for the preparation of a dissertation" and Resolution of the Cabinet of Ministers of Ukraine of 12-th January, 2022, No. 44 "On approval of the Procedure for awarding the degree of Doctor of Philosophy and cancellation of the decision of the one-time specialized academic council of the institution of higher education, scientific institution on awarding the degree of Doctor of Philosophy" with changes introduced in accordance with Resolution of the Cabinet of Ministers, No. 341 dated 03/21/2022. He Songtao deserves to be awarded the scientific degree of Doctor of Philosophy , in the Specialty of 101 – Ecology

Official Reviewer:

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professor, professor of the department
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