REVIEW

of the official reviewer

Doctor of Agriculture science, senior scientist,

Head of wheat breeding laboratory, Institute of plant breeding named after V.Ya. Yuryev National Academy of Agrarian Sciences

Leonov Oleh Yuriiovych

for the PhD thesis **Qiaoyan Chen** "Breeding and genetic bases of winter wheat ear traits",

submitted for Doctor of Philosophy scientific degree

Field of knowledge: 20 – Agricultural Sciences and Food

Specialty 201 – Agronomy

1. **Relevance of the topic of the dissertation.** The search for more effective approaches to the creation, evaluation and improvement of breeding material for wheat. MicroRNA expression was analyzed and differential expression was established. Expression patterns of randomly selected miRNAs and targets were confirmed by real-time quantitative polymerase chain reaction with consistent and reliable results. The roles of miRNAs and their targets during the early development of wheat grain were established, which made it possible to elucidate the molecular mechanisms underlying grain development and to implement molecular improvements in wheat breeding.

2. **Connection of work with scientific programs, topics, plans.** The dissertation is an integral part of the research topic of the Department of Breeding and Seed Production named after M.D. Goncharova of the Sumy National Agrarian University "Development of bioadaptive and ecologically oriented technologies for the cultivation of grain crops taking into account agrotechnical measures and agrobiological control of plant growth and development in the conditions of the North-Eastern Forest Steppe of Ukraine" (state registration number 0119U103779).

3. Scientific novelty of the obtained results. Based on the generalization of research results, the author established the genetic mechanism of such traits as the number of grains and the weight of a thousand grains in wheat, used SSR molecular markers to construct a genetic linkage map and QTL analysis, created a cartographic population and a map of genetic linkage of wheat, which contains 143 loci of molecular markers and covers 19 wheat chromosomes, with a total genome length of 3128.17 cM, an average marker distance of 25.23 cM, and a minimum genetic distance of 3.57 cM. 32 new miRNAs from the 7 DAP library and 78 new miRNAs from the 14 DAP library were identified. The molecular mechanisms of wheat grain development were clarified and molecular improvements in wheat breeding were made.

4. Scientific and practical significance. The genetic mechanism of such ear traits as the number of grains and the weight of one thousand grains was analyzed and studied, SSR molecular markers were used to construct a genetic linkage map and QTL analysis related to the studied traits, and a basis was created for the genetic improvement of wheat yield traits. A wheat genetic linkage map containing 143 molecular marker loci covering 19 wheat chromosomes was created and it was shown that there are random loci in the chromosomes that do not directly affect the phenotype, but these loci can affect the phenotypic traits through interactions with each other. Dissertation work clearly formulated goal, task, research methodology, research results really have modern scientific novelty. Modern methods of molecular biology and statistical analysis were used to analyze the conducted research. Prospective forms of wheat were identified based on a complex of economically valuable traits for inclusion in the further breeding process.

5. Completeness of presentation of the dissertation material in scientific publications. The main provisions and results of the research are presented in 12 scientific publications, six of them in collections of scientific works of International Scientific and Practical Conferences, two articles in

scientific specialized journals with reference to Scopus, three articles in scientific specialized publications of Ukraine.

6. The degree of validity of scientific provisions. The research program and methodology are well developed, the studied options are accompanied by a sufficient number of records and observations and analyses. Scientific provisions based on research results, conclusions, and recommendations of the dissertation are based on the fundamental works of both domestic and foreign authors on wheat genetics and breeding. The selective evaluation of research results was carried out according to modern methods, which gives grounds for asserting that the conclusions and proposals presented in the dissertation are well-founded and reliable.

7. The structure and content of the dissertation, its completeness and compliance with the established requirements for design. The dissertation is laid out on 186 pages of a computer set and consists of an introduction, three chapters that contain 15 tables, 14 figures, conclusions, recommendations for breeding practice, 19 appendices, a list of used literature containing 204 titles.

8. Discussion clauses and remarks to the dissertation.

- The abstract mentions the combination Mexico Very LargeColossus/Bainong 419, the second section Mexican Large Spike /Bainong 419, and the third section mentions the variety Bainong 4199. If Mexico Very Large Colossus and Mexican Large Spike and Bainong 419 and Bainong 4199 are different samples, then the structural elements of the thesis are not related to each other.

- The abstract in Ukrainian is written carelessly, individual sentences are unclear.

- From table 2.2, it is not clear what the values of the weight of one thousand grains and the number of grains per ear of parental forms are and whether they differ significantly.

- The paper discusses QTL loci related to the number of grains in an ear, but pages 83-84 refer to QTL loci related to the number of ears; the mass of a thousand

grains is marked either TGW or TKW (chapter 3); it is better to use the more common "F2" instead of "F2" and "µl" instead of "ul".

- In some places there are extra spaces and they are missing where they are needed; the items of the same list are given either from a paragraph or completely (subsection 2.2.5); alignment is sometimes by width, then by center (chapter 3), the figure and name are given on different pages (figure 2.4); separate sentences are completely repeated and there are incomplete ones.

- To figure 3.1, neither the legend nor the caption indicates the volume and weight of what is being said, in the first photo it is 4DAP, and in the caption – 0DAP; in table 3.1, the digits are sometimes separated by commas, sometimes not; on page 101, "r<0.05" is indicated, and it is about a differential manifestation, apparently we are talking about p<0.05.

- The poor resolution of many pictures does not allow you to get information from them.

The given comments and wishes cannot negatively affect the conceptual provisions of the dissertation and the scientific value of the original scientific work.

9. General conclusion. Chen Qiaoyan's dissertation "Molecular-genetic basis of winter wheat ear traits", which was submitted for defense to the specialized academic council for obtaining the degree of Doctor of Philosophy in the field of knowledge 20 - Agrarian sciences and food with a specialty 201 - Agronomy, according to its relevance, scientific and theoretical level, the main results of validity, the main provisions and results published in professional publications, the novelty of the statement and the practical significance meet the requirements of the order of the Ministry of Education and Culture of Ukraine No. 40 of January 12, 2017 "On approval of requirements for the preparation of a dissertation" and Resolution of the Cabinet of Ministers of Ukraine of January 12, 2022 No. 44 "On the approval of the Procedure for awarding the degree of Doctor of Philosophy and the 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" as amended in accordance with Resolution of the Cabinet of Ministers No. 341 dated 03.21.2022.

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