

FEEDBACK

from the official opponent candidate of agricultural sciences, associate professor **ILCHUK Ihor Ivanovich** for dissertation of **Qiao Yingying** (Цзао Іньїнь) «Development of technological methods of growing and use the plant extracts to improve the meat quality of broiler chicken», («Удосконалення технологічних прийомів вирощування та використання рослинних екстрактів для покращення м'ясних якостей курчат-бройлерів»), applied for the degree of Doctor of Philosophy, from the field of knowledge 20 - "Agrarian sciences and food" in the specialty 204 - "Technology of production and processing of animal husbandry products"

1.Relevance of the dissertation topic. The broiler-chickens are sensitive to external factors. Violations of conditions of maintenance and feeding cause a decrease in immunity, diseases and low preservation. In the last few decades, feed antibiotics have been used in intensive poultry farming to control disease and to stimulate growth. The use of phytobiotics in poultry feed began with the ban on feed antibiotics in a number of countries. The use of antibiotics leads to the mutation of microorganisms and their acquisition of resistance. In addition, antibiotics can accumulate in products. Phytobiotics are natural feed additives of plant origin that have various effects on the body: antimicrobial, antiviral, antifungal, immunomodulating, etc. However, the effect of phytobiotics on the animal body is not only related to antimicrobial action. They have a positive effect on digestion processes, stimulating the secretion of enzymes and assimilation of nutrients. In addition, phytobiotic preparations are natural flavours that stimulate feed consumption and increase poultry productivity.

Astragalus polysaccharide (APS) is the main component of an extracted water-soluble heteropolysaccharide from the stems or dried roots of *Astragalus membranaceus*, which has diverse biological activities, including antioxidant, anti-inflammatory, antibacterial and antiviral, as well as immunomodulatory properties. APS stimulates growth by increasing the activity of digestive enzymes and antioxidants. Glycyrrhiza polysaccharides (GPS) are one of the main active components of *Glycyrrhiza uralensis*. GPS stimulates immunity, phagocytosis, antifungal properties and stimulates macrophages.

The addition of *Astragalus* and *Glycyrrhiza* extracts to the diets of broiler chickens, their effect on productivity, use of feed, product quality, and physiological indicators of the body have not been sufficiently studied. Accordingly, Qiao Yingying dissertation research on the topic: "Development of technological methods of growing and use the plant extracts to improve the meat quality of broiler chicken" is relevant and timely.

2. Connection of work with scientific programs, plans, topics. The dissertation work was done in accordance with the plan of research work of Sumy National Agrarian University and Henan Agricultural University. For the results of these studies, the theoretical basis for the use of *Astragalus* and *Glycyrrhiza*

extracts as an alternative to antibiotics in the production of broiler meat, as well as the use of steam and boiling meat processing technologies, was developed. These results represent effective approaches to the safe production of poultry products.

3. The purpose and objectives of the research The work has scientific novelty. For the first time, the effects of Astragalus and Glycyrrhiza extracts and their combinations on broiler performance, meat quality, antioxidant, immune and intestinal barrier function were systematically studied. The using the analysis of intestinal microbial diversity, a possible mechanism of influence of Astragalus and Glycyrrhiza extract on the development of microorganisms was studied. Installed that Astragalus and Glycyrrhiza extracts, separately or in combination, can increase the number and microbial diversity of the cecum and improve the structure of the intestinal microflora. Extracts can improve the structure of the villi of the small intestine of broilers and affect the permeability of the intestine and trachea. The studied additives can improve the functioning of antioxidant systems and immune functions in broiler chickens, inhibit the occurrence of inflammatory factors.

4. Scientific novelty of the obtained results. For the first time, effective levels of the introduction of Astragalus and Glycyrrhiza extracts into compound feed for broiler chickens were established. The best results were obtained using a combination of: Astragalus extract – 150 mg/kg and Glycyrrhiza extract – 75 mg/kg. Their use allows you to increase the body weight of broiler chickens by 6.78% and increase the net profit per body carcass by \$0.113.

The addition of Astragalus and Glycyrrhiza extracts to the compound feed of broiler chickens led to an improvement in the quality of meat, both by steaming and boiling technologies. The extracts improved the colour, crude protein and unsaturated fatty acid content of broiler chicken muscles. The technology of steam processing contributed to greater preservation of the nutritional components of meat compared to the technology of cooking, extending the shelf life. The recommended steaming time is 30 minutes.

5. Number of scientific publications.

The main results of the dissertation have been published a total of 20 articles based on the research results of the dissertation, including 6 articles in scientific professional publications of Ukraine, 1 article in scientific journals of other countries, 4 articles published in journals indexed in Scopus and Web of Science Core Collection, and 9 theses of the reports.

6. Evaluation of the main content and design of the work. To achieve the goal, a set of tasks was developed, the implementation of which allowed the dissertation student to obtain objective data. The gotten data in the experiments are based on the use of modern analytical, chemical, zootechnical, biochemical, microbiological, morphological and statistical methods. The experimental part of the work was performed methodically correctly on a sufficient amount of material. The conclusions are well-argued, consistent with theoretical data and the results of experimental research. The obtained results are of great practical importance. In the dissertation, the tasks were completed taking into account modern scientific requirements.

An analysis of the plagiarism check report for the presence of textual borrowings (Strike plagiarism) was carried out. The reviewers came to the conclusion that Qiao Yingying (Цзао Іньїнь) «Development of technological methods of growing and use the plant extracts to improve the meat quality of broiler chicken», («Удосконалення технологічних прийомів вирощування та використання рослинних екстрактів для покращення м'ясних якостей курчат-бройлерів») is the result of independent research of the acquirer and does not contain elements of plagiarism and borrowing in accordance with the resolution of the CMU dated 12.01.2022 No. 44, paragraph 9. The used ideas, results and texts of other authors have a link to the corresponding source.

7. Structure and scope of the dissertation. The work is presented in a meaningful way. The style of presentation is scientific.. The dissertation is presented on 165 pages. The work consists of an abstract, introduction, literature review – 32 pp. (19%), materials and research methods – 12 pp. (7%), results of own research and their analysis - 45 s (27%), discussion - 16 s. (10%), conclusions, list of used sources and applications. The experimental part of the dissertation contains 14 tables and 19 figures. The bibliography includes 198 sources. Scientific terms are used correctly and appropriately and do not overload the work, so its content is clear and accessible.

In general, the acceptable structure of the dissertation allowed us to focus on key areas and main aspects of the problem under study. The dissertation meets the established requirements for its formatting.

8. Remarks and wishes regarding the content.

1. Clear background and motivation: The beginning of the abstract provides background information, explaining the issues with antibiotic use in poultry farming and the necessity of plant extracts as potential antibiotic alternatives. This is a good start, but it could further provide some relevant statistical data or specific previous research questions to present the research motivation more clearly.

2. Literature review: The content of the literature review is quite extensive, but it is suggested to emphasize previous studies directly relevant to this research, particularly the application of Astragalus and Glycyrrhiza extracts in poultry and their effects on the intestinal and immune systems.

3. Summary of results: In the third section, the experimental results are summarized, but it is suggested to discuss the experimental results more deeply.

4. Innovation and significance of the study: The part emphasizes the innovation of the study, particularly through new methods such as analysis of intestinal microbial community diversity. It clearly articulates the practical applications of this research and its importance to the broiler farming industry.

5. Future research directions: The plans for further research are mentioned in the final section, which is a good addition. It is suggested to provide more detailed explanations of future research directions and how these directions will expand the research field.

