SUMMARY

Evaluation of the efficacy of a disinfectant containing permethrin, ultramarine and violet 23 in broiler chicken house

Sara Dzik, MSc

The safety of food products should be closely monitored already at initial stages of production. Poultry meat is considered as one of the main pathogen carriers in the group of animal-based products, and food safety remains a priority for both consumers and producers. Due to an increase in poultry meat consumption, appropriate measures should be taken to maintain high broiler productivity and flock health. However, this is not an easy task; effective bird protection against infections poses a continuous challenge in poultry production despite numerous research studies and progress in disease prevention and treatment as well as the implementation of innovative technical and technological solutions. Therefore, particular attention should be paid to ensuring biological safety on the farm. The main sources of infection in poultry farming include employees, farm equipment, other livestock, the immediate environment, insects (e.g. *Alphitobius diaperinus*) – which often are not treated as a serious threat, rodents and wild birds. Properly selected disinfection and disinsection methods play a key role in poultry farms and contribute to maintaining the safety of poultry products, which is particularly important under intensive production systems.

Numerous commercial products are available for maintaining high hygiene standards in poultry farms, but their efficacy raises certain concerns. Therefore, the biology and behavior of insects whose populations are to be controlled in broiler houses should be thoroughly investigated. Microbiological analyses confirming the effectiveness of selected agents should be performed not only in the laboratory, but also on the farm, and the effects of these products on broiler performance and health should be determined. In view of the above, the main objective of this study was to comprehensively evaluate the efficacy of a biocidal paint containing antimicrobial and insecticidal active ingredients and its potential use as a long-lasting disinfectant and disinsectant in broiler houses.

In order to achieve the objective of doctoral research, several research tasks were performed, and the obtained results were described in four manuscripts. A critical literature

review regarding *A. diaperinus* was performed in the study described in **review article 1** (Mituniewicz and Dzik, 2020). Based on the acquired data on this pest insect affecting poultry production, its biology, harmful effects and control methods were described. **Research article 2** (Dzik and Mituniewicz, 2020) focused on an analysis of the efficacy of a biocidal paint applied in a poultry house as a disinfectant with insecticidal activity (against *A. diaperinus*). Control of pest insect populations in poultry houses is necessary, but difficult to achieve. Nevertheless, attempts should be made to control *A. diaperinus* because this beetle species constitutes a serious threat to human and animal life and health. The study described in **research article 3** (Dzik et al., 2022) investigated the spatial location of *A. diaperinus* in different sections of poultry houses to determine whether its presence can be effectively monitored with the use of a biocidal paint. The efficacy of this disinfectant was also analyzed, including its impact on microclimate conditions in the building and the basic physicochemical properties of litter. The study described in **research article 4** (Dzik et al., 2022) was conducted to determine whether the applied biocidal paint, as a disinfectant with insecticidal active ingredients, affects the performance and selected blood biochemical parameters of broilers. Moreover, each of the above studies evaluated whether the tested biocidal paint remained effective during the entire experiment and can be recommended as a long-lasting disinfection and disinsection method. Its effectiveness in maintaining high hygiene standards in poultry farms was also compared with that of liming.

It was found that the tested biocidal paint applied in broiler houses as a disinfectant with insecticidal properties is not a fully effective method for direct control of *A. diaperinus* infestations, but it can be useful for monitoring its presence and developing new control strategies. In addition, the application of the biocidal paint in poultry houses significantly reduced microbial air contamination, did not deteriorate litter quality or microclimate parameters, did not compromise broiler performance and had no negative influence on selected blood biochemical parameters. However, further research (including histopathological analyses) is needed to confirm that the active ingredients contained in the paint exert no toxic effects on birds. It was found that the tested biocidal paint was more effective than liming, and that it can be recommended as a long-lasting disinfectant and disinsectant in poultry houses.

The results of the presented doctoral research have scientific value and practical implications, providing the necessary knowledge and tools for poultry producers. They can considerably contribute to improving sanitary conditions in poultry farms, and provide a basis for developing effective hygiene procedures. Several conclusions and recommendations for practitioners in the field of poultry farming were formulated. The analyzed biocidal paint

is more effective and less laborious to apply than liming. The paint can be applied once a year only, which saves time, and its effects are better than or comparable with those of limewash that has to be applied before each production cycle. After the application of the biocidal paint, *A. diaperinus* individuals were located in the middle section of the building. If the places where pest insects are likely to be found in the highest numbers are known, additional pest management tools can be applied. For instance, a biocidal paint could be combined with a natural litter additive, which could also prevent the emergence of *A. diaperinus* resistance to popular chemical substances. Furthermore, taking into account the sex of pest insects could support effective control of their populations. This is an important consideration since males and females may differ in their sensitivity to insecticides. Poultry producers should regularly determine the insecticide susceptibility of insects and the drug resistance of microorganisms isolated from poultry houses so that biologically active ingredients could be used in rotation. Such measures could reduce insecticide and antimicrobial resistance in a given population.

The results of doctoral research revealed that the tested biocidal paint is an effective disinfectant and disinsectant; it has no significant effect on microclimate conditions, litter quality, performance parameters or selected blood biochemical parameters of birds. This doctoral dissertation may provide a new path for research. The present findings can contribute to reducing the use of chemicals in agriculture, which is consistent with the principles of sustainable development. However, more research is needed in this area.

Key words: environmental hygiene, disinsection, lesser mealworm, microorganisms, litter quality, microclimate, broiler performance