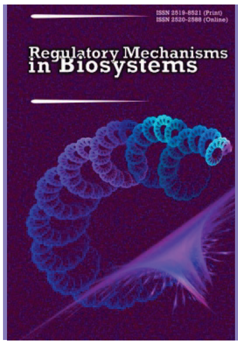

Regulatory Mechanisms
in Biosystems

ISSN 2519-8521 (Print)
ISSN 2520-2588 (Online)
Regul. Mech. Biosyst.,
2024, 15(4), 696–701
doi: 10.15421/0224100

In vitro tests of effect of disinfectants on the viability of *Heterakis gallinarum* nematode eggs during embryogenesis

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Article info

Received 24.08.2024
Received in revised form 02.10.2024
Accepted 18.10.2024

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Yevstafieva, V., Omelchenko, O., Melnychuk, V., Dmitrenko, N., Krykunova, V., Peredera, O., & Tahiltseva, Y. (2024). In vitro tests of effect of disinfectants on the viability of Heterakis gallinarum nematode eggs during embryogenesis. Regulatory Mechanisms in Biosystems, 15(4), 696–701. doi:10.15421/0224100

Affecting the transmission of an infection, objects of the external environment become contaminated with pathogens as a result of their massive release by the definitive host during exogenous stages of parasites' development, which is an important chain of their epizootic process. Therefore, disinfestation plays an important role in the complex of measures for the prevention and control of poultry helminthiases, including *Heterakis gallinarum* infection of chickens. The purpose of the research was to investigate in laboratory conditions the ovicidal efficiency of modern disinfectants in relation to the viability of developing eggs of *H. gallinarum* isolated from infested chickens. "Hermecid-VS" (didecyldimethylammonium chloride, glutaraldehyde, benzalkonium chloride) and "Arquadez-plus" (dimethyldialkylammonium chloride, didecyldimethylammonium chloride, tetrasodium salt) disinfectants were tested. These preparations had a high level of ovicidal efficiency against the eggs of *Heterakis*, "Hermecid-VS" in 0.25% and 0.5% concentration for exposures of 10–60 min (93.5–100.0%), "Arquadez-plus" in 1.0% concentration for exposure of 60 min (93.1%), and at 1.5% (96.8–100.0%) and 2.0% (100.0%) concentrations regardless of exposure. The ovicidal effect of disinfectants was characterized by morphological changes in the nematode eggs when using "Hermecid-VS" – accumulation of air bubbles under the shell, thinning and deformation of the shell, death and gradual resorption of the embryo, loosened egg shell and terminated embryonic development, deformation and thinning of egg the shell, and death of the embryo at the stage of formation of the larva; under the effect of "Arquadez-plus", a stop in development at the stage of cleaving blastomeres, destruction of the shell, death and evacuation of the embryo from the egg, shrinkage and gradual defragmentation of the embryo, death of the larva and its defragmentation. Under the action of disinfectants, the metric parameters of *Heterakis* eggs also changed. Under the influence of "Hermecid-VS" at all concentrations, the length of the eggs and the thickness of the shell were larger (by 2.9–5.4% and 26.7–46.7%), and their width was smaller (by 5.5–6.9%). With the effect of "Arquadez-plus", the length of the eggs was greater (by 0.4–2.0%), and the width was smaller (by 0.7–4.9%) only when using 0.1–2.0% concentrations of the agent. *Heterakis* egg shell thickness increased under the influence of "Arquadez-plus" in concentrations of 0.25–2.0% (by 33.3–40.0%). The conducted studies allow us to recommend "Hermecid-VS" and "Arquadez-plus" disinfectants in specified concentrations and modes of their use for maintaining epizootic well-being in the complex of measures against *Heterakis* infection of chickesn.

Keywords: *Heterakis* infection; chicken; exogenous development; disinfestation; ovicidal efficiency.

Introduction

Anthropogenic intervention in the functioning of parasitic systems involves the activation of local foci of natural parasitosis, the increase in the survival of parasites on the one hand, and the decrease in the resistance of hosts on the other. At the same time, parasites themselves can act as indicators of general environmental pollution (Sures et al., 1999; Araújo et al., 2003; Gagne et al., 2022; Lehun et al., 2023).

The formation of specific parasitic systems, which are almost not limited by natural self-regulation mechanisms, threatens the epizootic well-being of poultry farms and causes significant economic losses to agriculture. Such pathogens include the nematode *Heterakis gallinarum* (Schrank, 1788) Madsen, 1949. Though it is itself mildly pathogenic, it is also a vector of the causative agent of histomoniasis *Histomonas meleagridis*, which complicates the course of the infection and leads to significant mortality of birds, especially young ones (Lund et al., 1975; Schwarz et al., 2011; Cupo & Beckstead, 2019a; Dubey et al., 2024).

Heterakis infection is one of the most common helminthiasis of young farmed poultry (turkey, chicken, guinea fowl) and wild birds, recorded in many countries of the world. In particular, 60% of chickens on farms in Oran region (in North-West Algeria) were infested with *Heterakis* (Kerroucha et al., 2022). On poultry farms in Pankrono-Kumasi in the Ashanti Region of Ghana, the rate of infestation of chicken with *H. gallinarum* was 19%, in Kashmir, India – 26.83%, in and around Shimoga, India – 15.1%, in Narsingdi district, Bangladesh – up to 76%, in the Mekong Delta of Vietnam – up to 43.3% (Ferdushy et al., 2016; Javaregowda et al., 2016; Asumang et al., 2019; Van et al., 2020; Ara et al., 2021).

Such a significant distribution of *H. gallinarum* infection in poultry is associated with many factors. In particular, *Heterakis* are geohelminths, their development is direct and occurs without the participation of intermediate hosts. The period of formation of invasive eggs in the external environment lasts is only 1–3 weeks. The source of the infestation is a sick bird, infection is transmitted with food, feeders, pastures, contaminated with *H. gallinarum* eggs. Reservoir hosts are earthworms. Moreover, adult birds are carriers of *H. gallinarum* infestation throughout the year, thus they are a source of infection of young birds (Movsessian & Pkhrikian, 1994; Saunders et al., 2000; Belete et al., 2016). This situation requires purposeful control of poultry farming and maintenance of epizootic well-being in relation to *H. gallinarum*. One of the factors in the effective prevention of parasitic contamination is minimizing the contamination of the environment by parasite eggs, which will make it impossible for the bird to become infected. To this end, a significant number of works are devoted to the study of the ovicidal and larvicidal action of various chemical and natural agents against parasites of various species, taking into account the characteristics of each pathogen, its resistance at different stages of development, sensitivity to adverse environmental conditions and the action of the agents (Yevstafieva et al., 2019; Yevstafieva et al., 2020; Boyko & Brygadyrenko, 2022; Lazurska & Brygadyrenko, 2024). In particular, nine disinfectants and chemicals commonly used in poultry farming against a test culture of *H. gallinarum* eggs, namely: Clorox bleach (NaOCl), Green Klean, Decon7, Kem San, PLT, Virkon S, NaCl, dry limestone ($CaCO_3$), and diesel fuel, were tested *in vitro*. Only NaOCl and Green Klean damaged the nematode eggshell, and only one agent, NaOCl, had a detrimental effect on *Heterakis* larvae (Cupo & Beckstead, 2019b). Other researchers tested natural remedies of plant origin – bishkatali (*Polygonum hydropiper*), neem (*Azadirachta indica*), papaya (*Carica papaya*), bitter melon (*Momordica charantia*) and mahogany (*Swietenia macrophylla*) against *Ascaridia galli* nematode eggs. The authors proved that dust of bishkatali if added to the litter can be effectively used to inhibit the development of *A. galli* eggs (Islam et al., 2009). Also, the ovicidal effect of the most common commercial disinfectants on the embryogenesis of *A. columbae* eggs was evaluated, namely: formalin, povidone iodide, TH4, and Virkon-S. With the exception of Virkon-S, the tested disinfectants in concentrations used in poultry farms showed a high ovicidal effect on *Ascaris* eggs (Bessat & Dewair, 2019).

The purpose of the research was to investigate in laboratory conditions the ovicidal efficiency of modern disinfectants in relation to the viability of *Heterakis gallinarum* nematode eggs isolated from infested chickens during their embryonic development.

Materials and methods

The work was carried out at the Laboratory of Parasitology and Veterinary-Sanitary Expertise of the Department of Veterinary Medicine of Poltava State Agrarian University (Ukraine) in 2023–2024. In order to determine the ovicidal efficiency of the disinfectants "Hermecid-VS" and "Arkvadez plus", test cultures of non-invasive nematode eggs of *Heterakis gallinarum* were used, isolated from the gonads of *Heterakis* females obtained by dissecting the ceca of chickens collected from slaughterhouses in the Poltava region.

The product "Hermecid-VS" (Limited Liability Company "Vetsintez", Ukraine) contains active ingredients didecyldimethylammonium chloride (2.25%), glutaraldehyde (15%), benzalkonium chloride (8%). "Arkvadez plus" (O.L.KAR.-AgroZooVet-Service, Ukraine) contains active ingredients dimethyldialkylammonium chloride (10%), didecyldimethylammonium chloride (5%), tetrasodium salt (2.5%).

Petri dishes with a mixture of *H. gallinarum* eggs (at least 100 specimens) were prepared in laboratory conditions. Disinfectants in the following concentrations were added to each Petri dish: "Hermecid-VS" 0.1%, 0.25%, 0.5%; "Arkvadez plus" 0.25%, 0.5%, 1.0%, 1.5%, 2.0%. After the exposure (10, 30, 60 min), test cultures of *H. gallinarum* eggs were washed in distilled water and transferred to separate Petri dishes. A control test culture of *H. gallinarum* eggs was also prepared, in which distilled water was introduced instead of disinfectants. After that, the experimental and control cultures were placed in a thermostat at a temperature of 25 °C and cultivated for 12 days until the appearance of motile larvae in the *Heterakis* eggs. They were aerated and moistened every two days. The test for each disinfectant was repeated three times. Ovicidal efficiency (OE, %) was determined on the 12th day according to the method (Volkov & Simonov, 1977).

The morphometric parameters of *H. gallinarum* eggs (egg length and width, n = 15) during cultivation were studied using ImageJ for Windows® software (version 2.00) in interactive mode. Microphotography was carried out using a Sigeta M3CMOS 14000 14.0 MP digital camera (China).

Statistical processing of the experimental results was carried out using Statistica 10 (StatSoft Inc., USA) software. Standard deviation (SD) and average values (x) were calculated. Differences between the values of the groups were determined using the Tukey test, where the differences were considered significant at P < 0.05.

Results

The conducted studies established that the "Hermecid-VS" disinfectant has a high level of ovicidal efficiency against *H. gallinarum* eggs if used in concentrations of 0.25% and 0.50%, regardless of exposure. The OE ranged from 93.5% to 100.0% (Table 1).

Table 1
Ovicidal effect of "Hermecid-VS" on test culture of *Heterakis gallinarum* nematode eggs (%, x ± SD, n = 3)

Parameters of development	Time of exposure, min	Concentration of preparation		
		0.10%	0.25%	0.50%
Formation of motile larva, egg viable	10	22.7 ± 4.0^{c}	5.3 ± 2.5^{b}	0.0 ± 0.0^{a}
	30	7.3 ± 2.1^{b}	0.0 ± 0.0^{a}	0.0 ± 0.0^{a}
	60	9.3 ± 3.8^{b}	0.0 ± 0.0^{a}	0.0 ± 0.0^{a}
Arrested development, egg death	10	77.3 ± 4.0^{b}	94.7 ± 2.5^{d}	100.0 ± 0.0^{a}
	30	82.7 ± 2.1^{c}	100.0 ± 0.0^{a}	100.0 ± 0.0^{a}
	60	90.7 ± 3.8^{d}	100.0 ± 0.0^{a}	100.0 ± 0.0^{a}
Ovicidal efficiency, %	10	72.3 ± 5.8^{b}	93.6 ± 2.8^{c}	100.0 ± 0.0^{a}
	30	78.9 ± 3.3^{b}	100.0 ± 0.0^{a}	100.0 ± 0.0^{a}
	60	88.7 ± 4.3^{c}	100.0 ± 0.0^{a}	100.0 ± 0.0^{a}

Note: different letters in the table within each parameters indicate significant (P < 0.05) differences between groups according to Tukey test results.

"Hermecid-VS" at a concentration of 0.1%, regardless of exposure, showed a satisfactory level of ovicidal efficiency against *H. gallinarum* nematode eggs (72.3–88.7%). Also, at this concentration, from 9.3 ± 3.8% to 22.7 ± 4.0% of *Heterakis* eggs, which matured to the invasive stage on the 12th day, remained viable.

The ovicidal effect of "Hermecid-VS" was characterized by morphological changes of eggs in test cultures such as accumulation of air bubbles under the shell (Fig. 1a), thinning and deformation of the shell, death of embryo and its gradual resorption (Fig. 1b), loosened egg shell and terminated embryonic development (Fig. 1c), deformation and thinning of egg shell, and death of embryo at the stage of formation of larva (Fig. 1d).

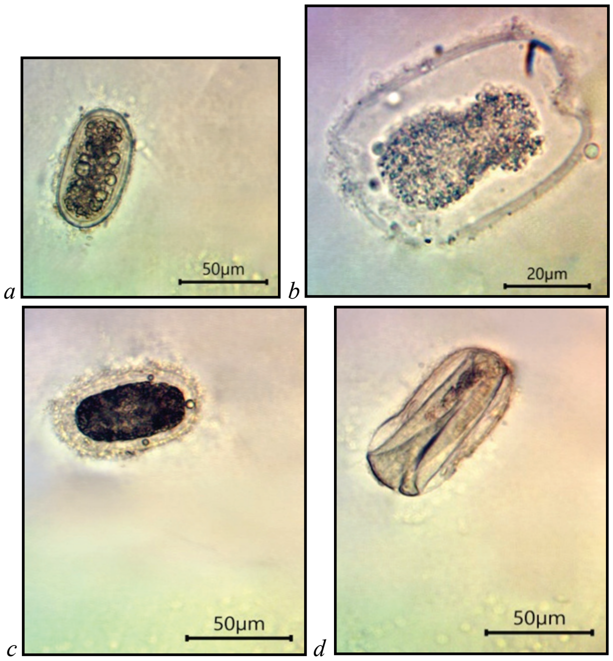


Fig. 1. Morphological changes in *Heterakis gallinarum* eggs under the action of "Hermecid-VS" disinfectant: *a* – accumulation of air bubbles under shell, *b* – thinning and deformation of shell, death of embryo and its gradual resorption, *c* – loosened egg shell and terminated embryonic development, *d* – deformation and thinning of egg shell, and death of embryo at the stage of formation of larva

"Arkvadez plus" preparation showed lower ovicidal activity against *H. gallinarum* eggs compared to "Hermecid-VS". A high level of ovicidal efficiency was established when using "Arkvadez plus" at 1.0% concentration for 60 min exposure (93.1%) and 1.5% concentration for 10 min exposure (96.8%): respectively, 6.3 ± 1.5% and 2.7 ± 1.2% Heterakis eggs matured to invasive stage (Table 2).

Table 2
Ovicidal effect of "Arkvadez plus" on test culture of *Heterakis gallinarum* nematode eggs (%, x ± SD, n = 3)

Parameters of development	Time of exposure, min	Concentration of preparation				
		0.25%	0.5%	1.0%	1.5%	2.0%
Formation of motile larva, egg viable	10	35.3 ± 5.7^{f}	25.7 ± 4.0^{d}	13.3 ± 2.1^{c}	2.7 ± 1.2^{ab}	0.0 ± 0.0^{a}
	30	31.7 ± 4.2^{de}	21.3 ± 2.1^{d}	10.0 ± 1.0^{c}	0.0 ± 0.0^{a}	0.0 ± 0.0^{a}
	60	29.7 ± 4.2^{de}	17.0 ± 2.0^{cd}	6.3 ± 1.5^{b}	0.0 ± 0.0^{a}	0.0 ± 0.0^{a}
Arrested development, egg death	10	64.7 ± 5.7^{ef}	74.3 ± 4.0^{e}	86.7 ± 2.1^{d}	97.3 ± 1.2^{b}	100.0 ± 0.0^{a}
	30	68.3 ± 4.2^{ef}	78.7 ± 2.1^{e}	63.3 ± 1.0^{f}	100.0 ± 0.0^{a}	100.0 ± 0.0^{a}
	60	70.3 ± 4.2^{ef}	83.0 ± 2.0^{d}	93.7 ± 1.5^{c}	100.0 ± 0.0^{a}	100.0 ± 0.0^{a}
Ovicidal efficiency, %	10	57.1 ± 7.1^{g}	68.8 ± 5.5^{fg}	83.8 ± 2.6^{de}	96.8 ± 1.3^{b}	100.0 ± 0.0^{a}
	30	61.5 ± 5.2^{g}	74.1 ± 2.7^{f}	87.9 ± 0.9^{d}	100.0 ± 0.0^{a}	100.0 ± 0.0^{a}
	60	64.0 ± 5.2^{fg}	79.3 ± 2.7^{e}	93.1 ± 1.7^{c}	100.0 ± 0.0^{a}	100.0 ± 0.0^{a}

Note: see Table 1.

100% ovicidal efficiency was established when using the agent in 1.5% concentration for exposures of 30 and 60 minutes and in 2.0% concentration regardless of exposure. A satisfactory level of ovicidal efficiency of "Arkvadez plus" was established when it was used at a concentration of 0.25% for exposure of 30 and 60 min (61.5% and 64.0%), in which case 31.7 ± 4.2% and 29.7 ± 4.2% of eggs developed to the invasive stage, respectively. Also, a satisfactory level of ovicidal efficiency of the agent was found when using it at a 0.5% concentration regardless of exposure (68.8–79.3%) and at a 1.0% concentration after exposure for 30 and 60 minutes (83.8% and 87.9%), with the number of eggs that remained viable gradually decreasing from 25.7 ± 4.0% to 10.0 ± 1.0%. An unsatisfactory level of ovicidal efficiency was found when using "Arkvadez plus" at a concentration of 0.25% for exposure of 10 min (57.1%), where 35.3 ± 5.7% of eggs developed to the invasive stage.

The ovicidal effect of "Arkvadez plus" was characterized by morphological changes of eggs in test cultures such as arrested development at the stage of blastomere cleaving (Fig. 2a), destruction of shell, death of embryo and its exit from the egg (Fig. 2b), shrinkage and gradual defragmentation of the embryo (Fig. 2c), death of the larva and its defragmentation (Fig. 2d).

In the control test culture, 82.3 ± 3.2% of eggs with mobile larvae inside were formed (Fig. 3a, 3b) and only 17.7 ± 3.2% died on the 12th day of cultivation.

Under the action of disinfectants, changes in the metric parameters of nematode eggs were found in addition to the morphological changes. With the effect of "Hermecid-VS", the length of egg turned out to be greater ($P < 0.05$) by 2.9% at the concentration of 0.1% (71.9 ± 2.2 μm), by 4.1% at 0.25% (72.8 ± 1.7 μm), by 5.4% at 0.5% (73.7 ± 1.8 μm) compared to that indicator of eggs in the control test culture (Fig. 4a) on the 12th day of cultivation. At the same time, under the effect of the disinfectant, the width of egg significantly ($P < 0.05$) decreased, and the shell thickness increased compared to the indicators of the eggs in the control test culture: by 5.5% and 40.0% (39.8 ± 1.4 and 2.1 ± 0.1 μm) at 0.25%, and by 6.9% and 46.7% (39.2 ± 1.3 and 2.2 ± 0.2 μm) at 0.5%, respectively by 26.7% (1.9 ± 0.2 μm) at a concentration of 0.1% – the shell thickness increased (Fig. 4b, 4c).

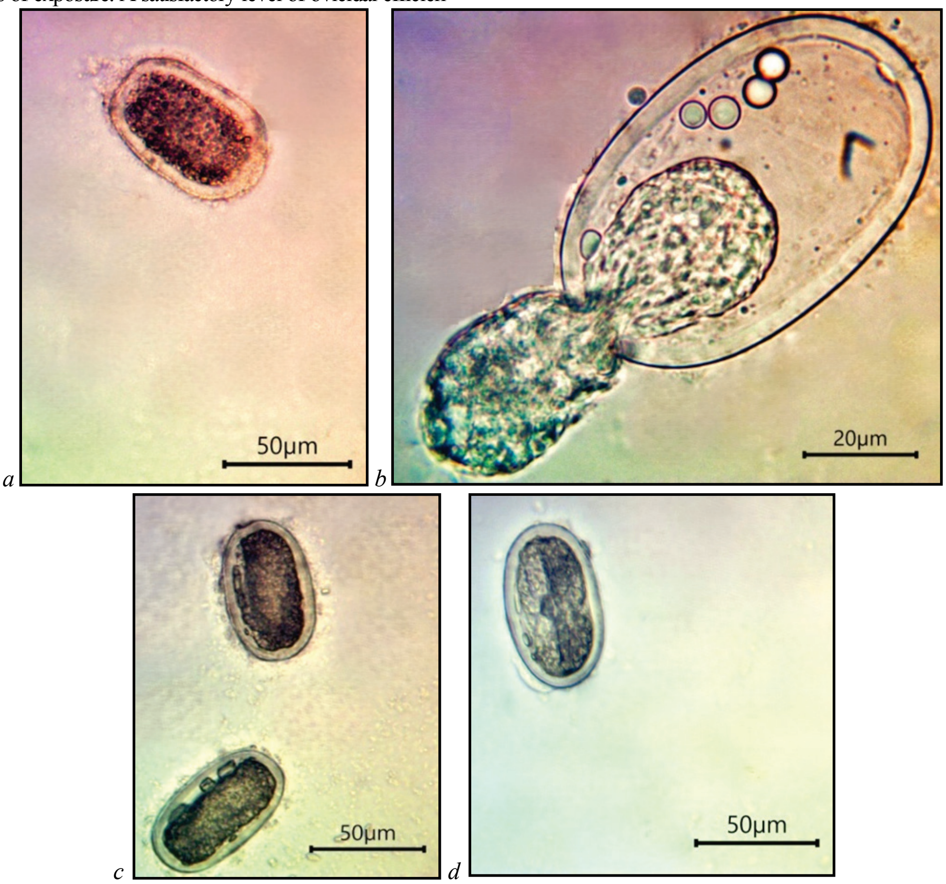
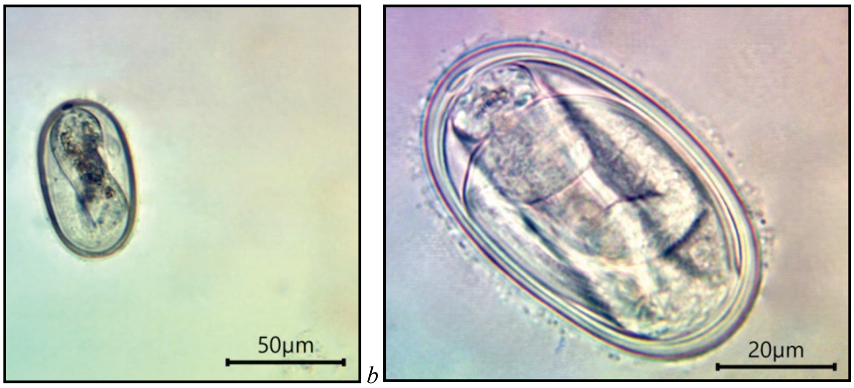
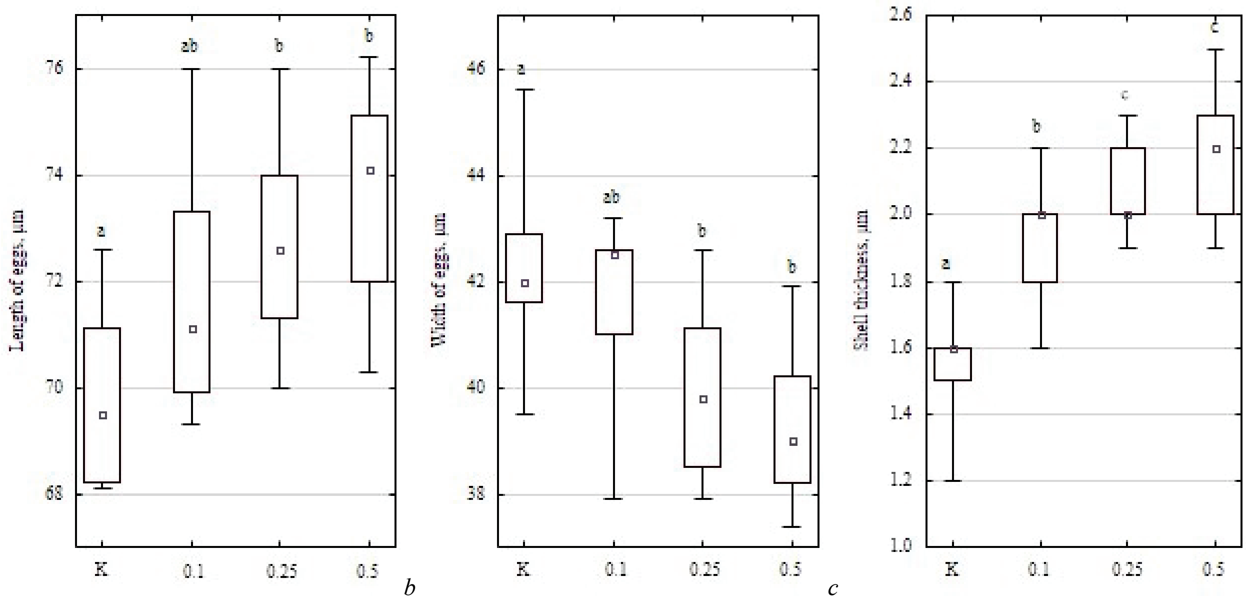


Fig. 2. Morphological changes in the eggs of *Heterakis gallinarum* under the action of "Arkvadez plus" disinfectant: *a* – arrested development at the stage of blastomere cleaving, *b* – destruction of shell, death of embryo and its exit from the egg, *c* – shrinkage and gradual defragmentation of the embryo, *d* – death of the larva and its defragmentation



a *b*

Fig. 3. Formation of motile larvae in *Heterakis gallinarum* eggs in the control test culture



a *b* *c*

Fig. 4. Metric parameters of *Heterakis gallinarum* eggs in test cultures when using "Hermecid-VS" disinfectant in different concentrations for 60 min exposure: *a* – length of eggs, *b* – width of eggs, *c* – shell thickness (µm); K – control; the small square in the center corresponds to the median, the lower and upper borders of the large rectangle correspond to the first and the third quartiles, respectively, vertical line segments, directed up and down from the rectangle, correspond to minimum and maximum values (n = 15); different letters in the figure indicate significant ($P < 0.05$) differences between groups according to the Tukey test results

Under the action of "Arkvadez plus", similar changes were observed on the 12th day of cultivation as after using "Hermecid-VS". In particular, the length of egg was significantly ($P < 0.05$) greater, and the width smaller by 3.7% and 5.9% (72.5 ± 1.9 and 39.6 ± 1.6 µm) at concentration of 0.1%; by 5.3% and 7.4% (73.6 ± 1.6 and 39.0 ± 1.2 µm) at 1.5% preparation solution; and by 5.4% and 6.9% (73.7 ± 1.8 and 39.2 ± 1.3 µm) at a concentration of 2.0%, compared to the indicators of eggs in control test culture (Fig. 5a, 5b). Under the action of the disinfectant, the shell thickness increased ($P < 0.05$) compared to that of eggs in the control test culture at a concentration of 0.5% by 33.3% (2.0 ± 0.2 µm), at 1.0% by 33.3% (2.0 ± 0.2 µm), at 1.5% by 40.0% (2.1 ± 0.2 µm), and at 2.0% by 40.0% (2.1 ± 0.1 µm) respectively (Fig. 5c).

In the control test culture, the length, width, and shell thickness of *H. gallinarum* eggs on the 12th day of cultivation were 69.9 ± 1.7, 42.1 ± 1.6, and 1.5 ± 0.1 µm, respectively.

Discussion

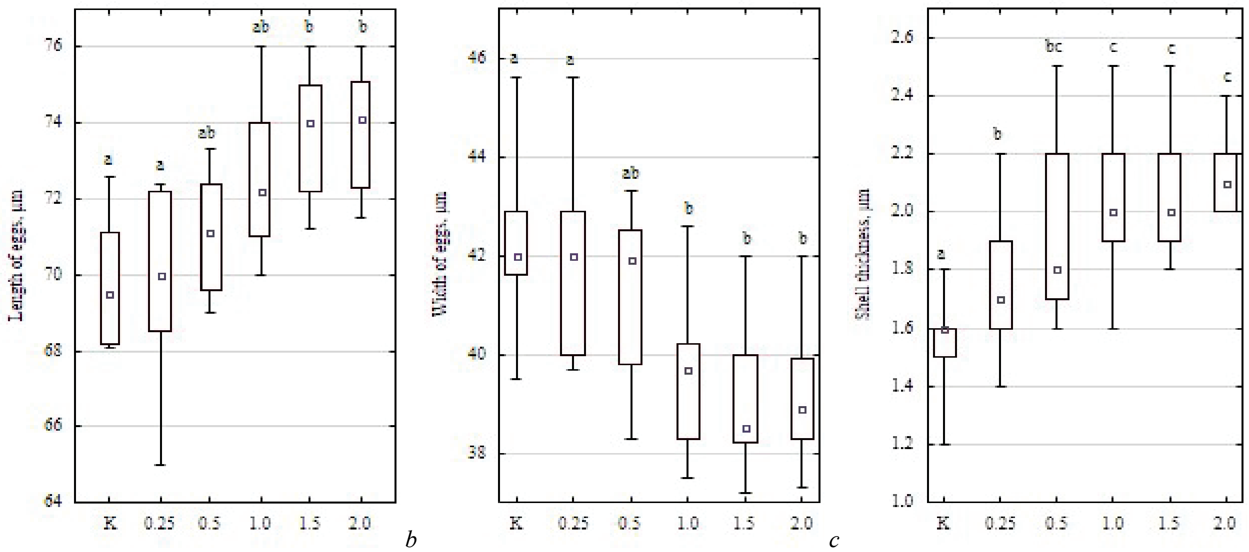
Successful development of poultry farming requires not only the creation of highly productive new breeds of chicken and improvement of rations in terms of nutrients, but also the stable epizootic well-being regarding invasive diseases, including *H. gallinarum* infection. The disease caused by *H. gallinarum* is widely prevalent and causes damage to poultry farming, also due to the fact that this parasite can carry the causative agent of histomoniasis, *Histomonas meleagridis*, which complicates the course of the invasion and leads to significant mortality of birds, especially among the young (Lund et al., 1975; Schwarz et al., 2011; Dubey et al., 2019a).

It is known that one of the important factors in the transmission of pathogens of helminthiases in animals, in particular poultry, is environmental objects due to their contamination with helminth eggs and larvae (Papini & Cacciuttolo, 2008; Thapa et al., 2017; Paliy et al., 2019). Therefore, the prevention of invasive diseases should be aimed at the effective destruction of pathogens of nematodoses at various stages of their development. Among them, the most common measure is the disinfestation of poultry facilities. In recent years, scientists have been conducting a number of studies to determine the disinfestation properties of modern disinfectants with the aim of using them in poultry farming to increase efficiency in the fight against and prevention of nematodoses (Islam et al., 2009; Bessat & Dewair, 2019; Cupo & Beckstead, 2019b).

Therefore, we evaluated two modern disinfectants, "Hermecid-VS" (a mixture of didecyldimethylammonium chloride, glutaraldehyde, benzalkonium chloride) and "Arkvadez plus" (a mixture of dimethyldialkylammonium chloride, didecyldimethylammonium chloride and tetrasodium salt) against the eggs of *H. gallinarum* nematodes that parasitize in chicken.

The conducted studies established that "Hermecid-VS" in 0.25% and 0.5% concentration during exposures of 10–60 min showed a high level of ovicidal efficiency against *H. gallinarum* eggs – 93.5–100.0%. When using the agent at a concentration of 0.25%, 94.7% of nematode eggs died after exposure for 10 minutes. Later, with increasing concentration and exposure, 100.0% death of eggs was detected. As the concentration and exposure of "Hermecid-VS" decreased, its effectiveness decreased and remained at a satisfactory level. The ovicidal efficiency of the agent at a concentration of 0.1% during exposure from 10 to 60 minutes ranged from 72.3 to 88.7%. "Arkvadez plus" showed lower ovicidal activity against *H. gallinarum* eggs compared to "Hermecid-VS". A high level of ovicidal efficiency was established when using "Arkvadez plus" in 1.0% concentration for exposure of 60 minutes – 93.1%, in 1.5% – 96.8–100.0% and in 2.0% – 100.0% for exposures from 10 to 60 minutes. When using the agent at a concentration of 1.0% after exposure for 60 minutes, 93.7% of nematode eggs died, at a concentration of 1.5% after exposure for 10 minutes – 97.3%. With increasing concentration and exposure, 100.0% death of eggs was detected. A satisfactory level of ovicidal efficiency (61.5–87.9%) of "Arkvadez plus" was established for concentrations of 0.25% (exposure 30–60 min), 0.5% (exposure 10 to 60 min), 1.0% (exposure 30 and 60 min). "Arkvadez plus" showed an unsatisfactory level of ovicidal efficiency (57.1%) at a concentration of 0.25% (exposure for 10 minutes).

In the available literature, the ovicidal effect of agents on *H. gallinarum* eggs was studied in a number of papers that proved the high efficiency of NaOCl, which had a detrimental effect on *H. gallinarum* larvae (Cupo & Beckstead, 2019b). Other researchers have tested natural and chemical remedies against the eggs of nematodes that parasitize birds, *Ascaridia galli* and *A. columbae* (Islam et al., 2009; Bessat & Dewair, 2019).



a *b* *c*

Fig. 5. Metric parameters of *Heterakis gallinarum* eggs in test cultures when using "Arkvadez plus" disinfectant in different concentrations for 60 min exposure: *a* – length of egg, *b* – width of egg, *c* – shell thickness (μm); see Fig. 4

The ovicidal effect of disinfectants was characterized by morphological changes in the nematode eggs. Thus, when using "Hermecid-VS", accumulation of air bubbles under the shell, thinning and deformation of the shell, death of the embryo and its gradual resorption were detected in the eggs of *H. gallinarum*. When "Arkvadez plus" was used, developmental arrest at the stage of blastomere cleaving, destruction of egg shell, death of embryo and its exit from the egg were detected in *H. gallinarum* eggs. We also discovered that under the action of disinfectants, in addition to morphological changes, there were changes in metric parameters of nematode eggs. Under the influence of "Hermecid-VS" at all concentrations, the length of egg and the thickness of egg shell turned out to be larger (by 2.9–5.4% and 26.7–46.7%), and egg width was smaller (by 5.5–6.9%). With the effect of "Arkvadez plus", the length of egg was greater (by 0.4–2.0%), and the width was smaller (by 0.7–4.9%) only when using 0.1–2.0% concentrations of the agent. Heterakis egg shell thickness increased under the influence of "Arkvadez plus" in concentrations of 0.25–2.0% (by 33.3–40.0%). There are reports that confirm the data we received regarding the harmful effect of disinfectants, which are manifested by morphological and metric changes in the eggs of *Aonchotheca bovis* and *Trichuris skrjabini* isolated from sheep (Melnychuk & Yuskiv, 2018; Petrenko & Kharchenko, 2023).

Therefore, the conducted studies allow us to recommend "Hermecid-VS" and "Arkvadez plus" disinfectants in the specified concentrations and modes of use for maintaining epizootic well-being in the complex of measures against *H. gallinarum* in chicken.

Conclusion

"Hermecid-VS" and "Arkvadez plus" have ovicidal properties against the eggs of *Heterakis gallinarum* nematodes, the effectiveness of which depended on the modes of their use. The "Hermecid-VS" product showed a high level of ovicidal efficiency in 0.25% and 0.5% concentrations (exposure from 10 to 60 minutes) – 93.5–100.0%. A satisfactory level of ovicidal efficiency of "Hermecid-VS" was established when using it in a 0.1% concentration (exposure from 10 to 60 minutes) – 72.3–88.7%. "Arkvadez plus" showed a high level of ovicidal efficiency in 1.0% concentration (60 min) – 93.1%, in 1.5% concentration (10 min) – 96.8% and (30–60 min) – 100.0%, in 2.0% concentration (exposure from 10 to 60 min) – 100.0%. A satisfactory level of ovicidal efficiency of "Arkvadez plus" was established when it was used in 0.25% concentration (30–60 min) – 61.5–64.0%, in 0.5% concentration (exposure from 10 to 60 min) – 68.8–79.3%, in 1.0% concentration (30 and 60 min) – 83.8 and 87.9%. "Arkvadez plus" showed an unsatisfactory level of ovicidal efficiency at 0.25% concentration (10 min) – 57.1%. The ovicidal effect of disinfectants was characterized by morphological and metric changes in test cultures of *H. gallinarum* eggs. During the exposure of 60 minutes on the 12th day of cultivation, the disinfectants led to an increase in the length of the nematode eggs and the thickness of their shell, as well as a decrease in the width of the eggs under the action of "Hermecid-VS", respectively, by 5.4%, 46.7% and 6.9%, under the action of "Arkvadez plus", respectively to 2.0%, 4.9% and 40.0%.

The authors state that there is no conflict of interest.

The research was carried out within the framework of the initiative topic of scientific work: “Ecological-faunistic monitoring and development of modern methods of diagnosis, measures to combat and prevent parasitic diseases in birds” (state registration No. 0121U107882), Ukrainian Institute of Scientific and Technical Expertise and Information, Ukraine; “Monitoring and improvement of means of diagnosis, treatment and prevention of infectious diseases of animals and poultry” (state registration No. 0123U101067), Ukrainian Institute of Scientific and Technical Expertise and Information, Ukraine.

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