Received: 16.09.2025 | Revision: 24.09.2025 | Accepted: 25.09.2025

Veterinary Sciences

doi: 10.31210/spi2025.28.04.20
UDC 614.44:616.995.132.8:636.52/58
ORIGINAL ARTICLE

Scientific Progress & Innovations
https://journals.pdaa.edu.ua/visnyk

28 (4)
2025

Disinvasive activity of modern disinfectants against *Ascaridia galli* nematode eggs

V. Melnychuk | O. Kovalenko | V. Yevstafieva | A. Zamaziy | O. Dolhin

Article info

Correspondence Author
V. Melnychuk
E-mail:
melnychyk86@ukr.net

Poltava State Agrarian University,
Skovoroda Str., 1/3,
Poltava, 36000, Ukraine

Citation: Melnychuk, V., Kovalenko, O., Yevstafieva, V., Zamaziy, A., & Dolhin, O. (2025). Disinvasive activity of modern disinfectants against *Ascaridia galli* nematode eggs. *Scientific Progress & Innovations*, 28(4), 136–141. doi: 10.31210/spi2025.28.04.20

Maintaining the well-being of poultry farms, increasing the number of birds, as well as enhancing their productivity depends on the implementation of therapeutic and preventive measures. Compliance with zoohygienic requirements and veterinary and sanitary rules for keeping chickens ensures veterinary well-being of farms, including with regard to nematodoses of the digestive tract. The aim of the research was to determine the disinvasive activity of modern disinfectants against eggs of the nematode *Ascaridia galli*, which parasitizes chickens. Under laboratory conditions, the destructive effect of domestically produced disinfectants was determined, including "Kristal-900" (active ingredients: glutaraldehyde, glyoxalaldehyde, benzalkonium chloride), "Creolin" (cresols, naphthalene, resin acids, pyridine bases and emulsifiers) and "Desirex Forte ParvoStop" (quaternary ammonium compounds, glutaraldehyde, non-inogenic surfactants) on a test culture of ascarid eggs isolated from the gonads of female nematodes. The conducted studies have established a high level of disinvasive effectiveness against *A. galli* nematode eggs of the following agents: "Krystal-900" – at 1.5 % concentration with exposure times of 1 h, 2 h and 3 h (90.3 %, 94.0 % and 100.0 % respectively); "Creolin" – at 4.0 % concentration for exposures of 2 and 3 h (92.9 and 100.0 % respectively) and at 5.0 % concentration for all exposure periods (100.0 %); "Desirex Forte ParvoStop" – at 0.5 % concentration with exposure times of 2 and 3 h (93.7 and 100.0 % respectively). Lower concentrations of the tested disinfectants, depending on the exposure duration, had either satisfactory or unsatisfactory levels of disinvasion efficiency against the eggs of the nematode *A. galli*. The destructive effect of disinfectants was accompanied by changes in the morphological structure of the eggs, which were characterized by the arrest of their development and loosening of the embryo; destruction and loosening of the eggshell, disintegration of both the embryo and shell, and larval death. The obtained research results allow us to recommend the disinfectants "Krystal-900", "Creolin" and "Desirex Forte ParvoStop" in specific application regimens for the effective control and prevention of ascaridiosis in chickens.

Keywords: chickens, ascariasis, *Ascaridia galli*, nematode eggs, disinfestation, effectiveness.

Дезінвазійна активність сучасних дезінфектантів відносно яєць нематод *Ascaridia galli*

В. В. Мельничук | О. В. Коваленко | В. О. Євстаф'єва | А. А. Замазій | О. С. Долгін

Полтавський державний аграрний університет,
м. Полтава, Україна

Збереження благополуччя птахівничих господарств, збільшення поголів'я птахів, а також підвищення їх продуктивності залежить від здійснення лікувально-профілактичних заходів. Дотримання зоогігієнічних вимог та ветеринарно-санітарних правил утримання курей забезпечує ветеринарне благополуччя у господарствах, зокрема й відносно нематодозів травного тракту. Метою досліджень було визначити дезінвазійну активність сучасних дезінфектантів відносно яєць нематод *Ascaridia galli*, що паразитують у курей. У лабораторних умовах визначали згубну дію дезінфікуючих засобів вітчизняного виробництва: «Кристалу-900» (діючі речовини – глутаровий альдегід, гліоксалевий альдегід, бензалконію хлорид), «Креоліну» (крезоли, нафталін, смоляні кислоти, піридинові основи і емульгатори) та «Дезірекс Форте ParvoStop» (четвертинні амонієві сполуки, глутаровий альдегід, неіногенні поверхнево-активні речовини) на тест-культуру яєць аскаридій, виділених з гонад самок нематод. Результати проведених досліджень свідчать про високий рівень дезінвазійної ефективності відносно яєць нематод *A. galli* засобів: «Кристалу-900» – у 1,5 % концентрації при експозиції 1 год, 2 год та 3 год (90,3 %, 94,0 % та 100,0 % відповідно); «Креоліну» – у 4,0 % концентрації при експозиції 2 та 3 год (92,9 та 100,0 % відповідно) та у 5,0 % концентрації при всіх експозиціях (100,0 %); «Дезірекс Форте ParvoStop» – у 0,5 % концентрації при експозиції 2 та 3 год (93,7 та 100,0 % відповідно). Нижчі концентрації випробуваних дезінфікуючих засобів залежно від експозицій мали або задовільний або незадовільний рівень дезінвазійної ефективності відносно яєць нематод *A. galli*. Згубна дія дезінфектантів супроводжувалася змінами в морфологічній структурі яєць, які характеризувалися зупиненням їх розвитку та розрихленням зародку; руйнуванням та розрихленням оболонки; розпадом зародку та оболонки; загибеллю личинки. Отримані результати досліджень дозволяють рекомендувати дезінфікуючі засоби «Кристал-900», «Креолін» та «Дезірекс Форте ParvoStop» у визначних режимах застосування для ефективної боротьби та профілактики аскаридіозу курей.

Ключові слова: кури, аскаридіоз, *Ascaridia galli*, яйця нематод, дезінвазія, ефективність.

Бібліографічний опис для цитування: *Мельничук В. В., Коваленко О. В., Євстаф'єва В. О., Замазій А. А., Долгін О. С.* Дезінвазійна активність сучасних дезінфектантів відносно яєць нематод *Ascaridia galli*. *Scientific Progress & Innovations*. 2025. № 28 (4). С. 136–141.

Introduction

It is known that one of the factors of transmission of invasive diseases are environmental objects contaminated with pathogens of parasitoses. This occurs due to the release of a large number of eggs or larvae by the definitive host, which is an important link in the epizootic process in parasitic diseases. Therefore, in the complex of measures for the prevention and control of helminthiasis in poultry farming, disinfestation plays an important role [1–5].

It has been proven that pathogens of invasive diseases at exogenous stages of development in the external environment, unlike pathogens of infectious diseases, are more resistant to the effects of adverse environmental factors, including the effects of chemicals used for disinfection and disinfestation [6–10].

Scientists are constantly studying the disinfestation properties of various disinfectants against eggs or oocysts of parasites that are localized in poultry, with the aim of implementing them in measures to combat and prevent infestations. In particular, the authors have established that the disinfectants "Hermecid-BC" and "Arquadez Plus" have ovicidal properties against eggs of the nematode *Heterakis gallinarum.* Their effectiveness depended on the application regimens, where the product "Hermecid-BC" showed a high level of ovicidal efficacy (93.5–100.0 %) at 0.25 % and 0.5 % concentrations for exposures of 10–60 min. The product "Arquadez plus" showed a high level of ovicidal efficacy (92.3–100.0 %) at 1.0 % concentration for exposures of 60 min; at 1.5–2.0 % concentration for exposures of 10–60 min [11].

Four disinfectants, including formalin, povidone iodide, TH4 and "Virkon-S", were tested on embryogenesis of *Ascaridia columbae* eggs. Significant inhibition of embryonic development of nematode eggs by 80 %, 85 % and 98 % was found after treatment of the test culture with formalin, povidone iodide and TH4, respectively. At the same time, Virkon-S did not affect the embryogenesis of ascaridies [12]. It was determined that the disinfectants "DOPT-1" and "Brovadez-20" at a concentration of 1.5 % with an exposure of 60 min have pronounced ovicidal properties against *H. gallinarum* eggs. The number of deformed eggs of heterakis under the influence of these disinfectants was 90 % and 92 %, respectively. At the same time, the disinfectant "Septamin" at the same concentrations and exposures was not sufficiently effective (30 %) against *H. gallinarum* eggs [13]. There is a report where the high disinvasive effectiveness of the disinfectant "Stalosan F" against *A. galli*, *H. gallinarum* and *Capillaria obsignata* eggs was experimentally proven [14].

There are reports on the determination of the inhibitory effect of herbal remedies: *Polygonum hydropiper*, *Azadirachta indica*, *Carica papaya*, *Momordica charantia* and *Swietenia macrophylla* on the exogenous development of *A. galli* eggs. Depending on the form in which they were used (fresh juice, extract and leaf dust), the disinvasion activity varied significantly. It was found that 4% extract of *C. papaya* showed the highest efficacy (92.86 %). Also, *P. hydropiper* leaf juice at 20% concentration showed 88.46% inhibitory effect against *A. galli* egg development. *C. papaya* showed.

Therefore, it is relevant to continue research on testing modern disinfectants in laboratory conditions for ascaridiosis in chickens.

The aim of the study

The aim of the research was to determine the disinvasive activity of modern disinfectants against eggs of the nematode *Ascaridia galli*, which parasitize chickens.

Materials and methods

The research was conducted during 2025 on the basis of the Parasitology Laboratory of the Poltava State Agrarian University and in the conditions of private farms of the Poltava region, where chickens are kept.

In order to determine the disinvasive effectiveness of the disinfectants "Krystal-900", "Creolin" and "Desirex Forte ParvoStop", test cultures of non-invasive eggs of the nematode species *Ascaridia galli*, isolated from the gonads of female nematodes, which were obtained during the dissection of the small intestine of chickens, were used. The product "Crystal-900" contains active ingredients: glutaraldehyde (95.0 g), glyoxalaldehyde (70.0 g), benzalkonium chloride (87.5 g). The product "Creolin" contains active ingredients: cresols, naphthalene, resin acids, pyridine bases and emulsifiers. The product "Desirex Forte ParvoStop" contains active ingredients: quaternary ammonium compounds (6.0 %), glutaraldehyde (5–15 %), non-ionic surfactants.

In laboratory conditions, Petri dishes were prepared with a mixture of *A. galli* eggs (at least 100 specimens). Each dish was filled with disinfectants in the following concentrations: "Kristal-900" – 0.5 %, 1.0 %, 1.5 % (exposures: 1 h, 1.5 h, 2 h); “Creolin” – 2.0 %, 3.0 %, 4.0 %, 5.0 % (exposures: 1 h, 2 h, 3 h); "Desirex Forte ParvoStop" – 0.25 %, 0.5 % (exposures: 1 h, 2 h, 3 h). After the appropriate exposures, the test cultures of *A. galli* eggs were washed in distilled water and transferred to separate Petri dishes. A control test culture of *A. galli* eggs was also prepared, in which distilled water was added instead of disinfectants. After that, the experimental and control dishes were placed in a thermostat at a temperature of 25°C and cultivated for 20 days until the appearance of motile larvae in the ascarid eggs. They were aerated and humidified every day. The experiment for each disinfectant was repeated three times. The disinfestation efficiency (DE, %) was determined on the 20th day of cultivation.

The assessment of disinvasive efficiency was carried out according to the following indicators: high level of efficiency – 90–100%, satisfactory – 60–89%, unsatisfactory – up to 60%.

Microphotography of *A. galli* eggs was performed using a SIGETA M3CMOS 14000 14.0 MP digital camera (China).

Mathematical analysis of the obtained data was performed using the Microsoft Excel application package by determining the arithmetic mean (M) and standard error (m).

Results and discussion

The conducted studies have shown that the disinfectant "Krystal-900" showed a high level of disinvasive action against A. galli eggs in the following modes: at 1.5 % concentration with exposure for 1 hour – 90.3 %, 2 hours – 94.0 %, 3 hours – 100.0 %. A satisfactory level of disinvasive efficiency was established when using the product at 0.5 % concentration with exposure for 1.5 and 2 hours – 63.1 and 67.5 %, respectively; at 1.0 % concentration with exposure for 1 hour – 73.9 %, 2 hours – 76.9 %, 3 hours – 85.1 %. An unsatisfactory level of disinvasive efficiency was established when using the product at 0.5 % concentration with exposure for 1 hour – 57.8 % (***Fig. 1***).

However, in the control test culture, 89.3±1.5 % of eggs formed motile larvae and reached the invasive stage. Only 10.7±1.5 % of eggs died during their cultivation. Also, depending on the concentration of disinfectant and exposure, the number of ascaridies eggs that died ranged from 62.3±2.6 to 100.0±0.0 % of specimens (***Fig. 2***).

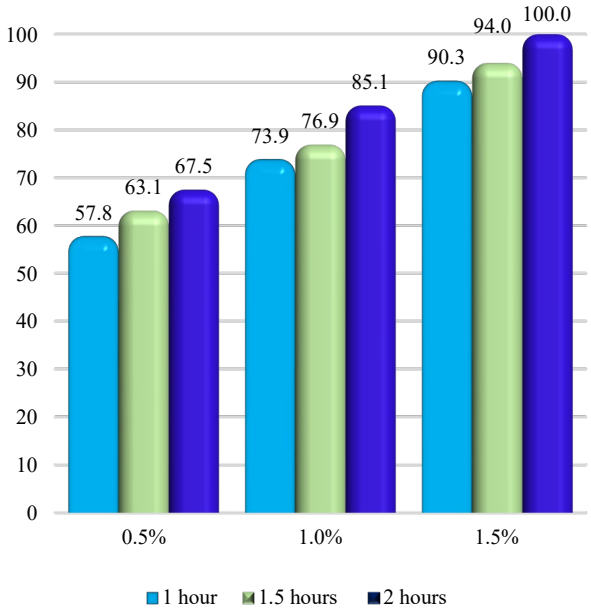

Fig. 1. Disinfection efficiency (%) of the disinfectant "Krystal-900" against eggs of the nematode *Ascaridia galli* (n=100)

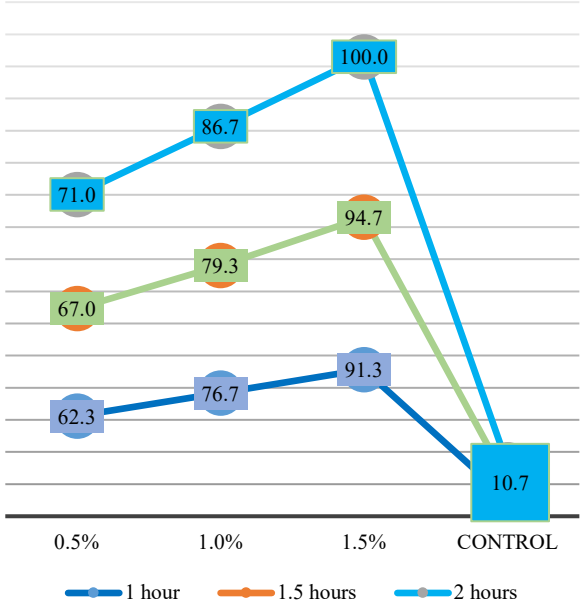

Fig. 2. Number of *Ascaridia galli* eggs (%) that died during their cultivation, under the influence of "Krystal-900" and in the control test culture

The disinfectant "Creolin" showed a high level of disinvasive action against *A. galli* eggs in the following modes: at 4.0 % concentration for 2 and 3 h exposure – 92.9 and 100.0 %, respectively; at 5.0 % concentration for 1 h, 2 h, 3 h exposure – 100.0 %. A satisfactory level of disinvasive efficiency was established when using "Creolin" at 2.0 % concentration for 3 h exposure – 60.8 %; at 3.0 % concentration for 1 h exposure – 63.8 %, 2 h – 71.3 %, 3 h – 84.0 %; at 4.0 % concentration for 1 h exposure – 89.2 %. An unsatisfactory level of disinvasive efficiency was established when using "Creolin" at a 2.0 % concentration with an exposure of 1 hour – 42.9 % (***Fig. 3***).

Depending on the concentration of the drug "Creolin" and its exposure, the number of ascaridies eggs that died ranged from 49.0±2.3 to 100.0±0.0 % of specimens (***Fig. 4***).

The disinfectant "Desirex Forte ParvoStop" showed a high level of disinvasive action against *A. galli* eggs at a 0.5 % concentration for 2 h exposure – 93.7 %, 3 h – 100.0 %. A satisfactory level of disinvasive effectiveness was established when using the product at a 0.25 % concentration for 3 h exposure – 68.7 %; at a 0.5 % concentration for 1 h exposure – 82.1 %. An unsatisfactory level of disinvasive effectiveness was established when using the product at a 0.25 % concentration for 1 h exposure – 39.2 % (***Fig. 5***).

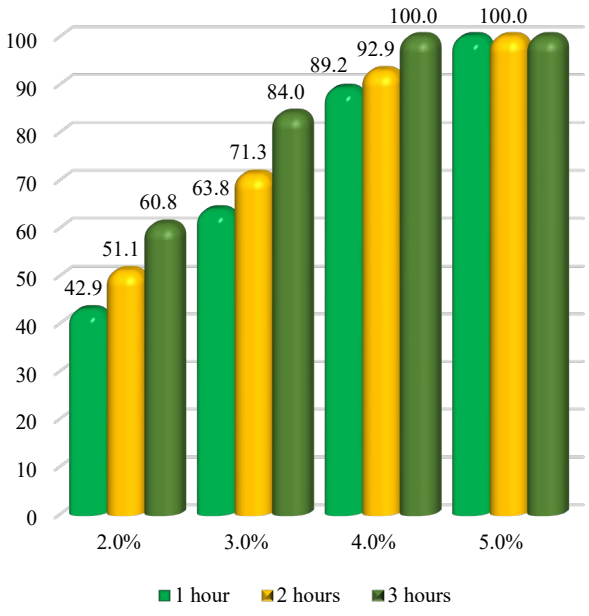

Fig. 3. Disinfection efficiency (%) of the disinfectant "Creolin" against eggs of the nematode *Ascaridia galli* (n=100)

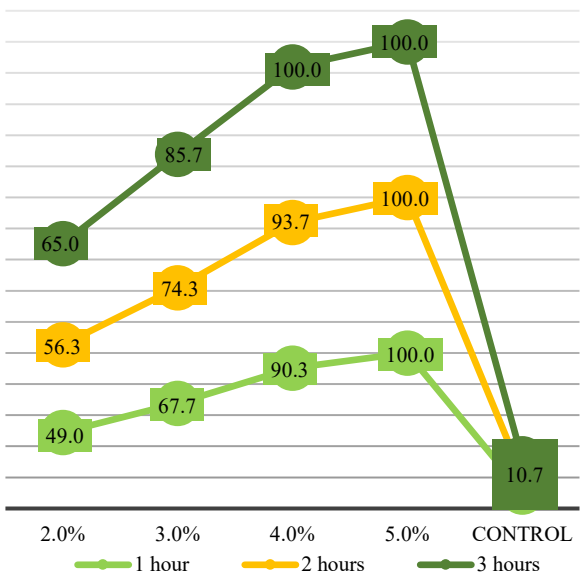

Fig. 4. Number of *Ascaridia galli* eggs (%) that died during their cultivation, under the influence of "Creolin" and in the control test culture

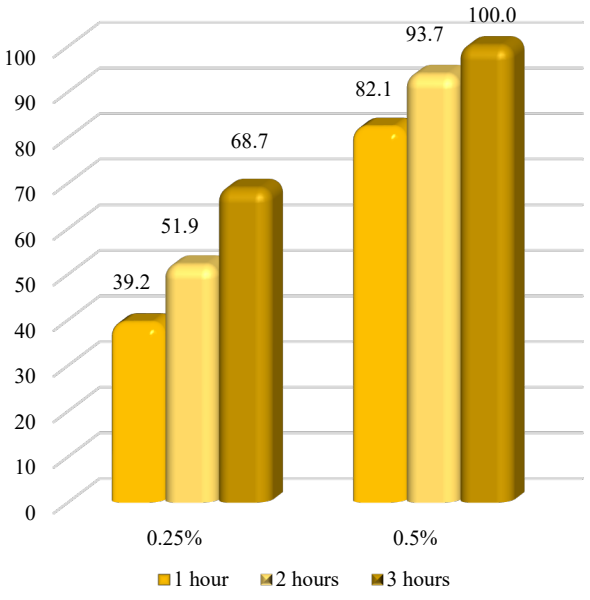

Fig. 5. Disinfection efficiency (%) of the disinfectant "Desirex Forte ParvoStop" against eggs of the nematode *Ascaridia galli* (n=100)

Depending on the concentration of the drug "Desirex Forte ParvoStop" and its exposure, the number of ascaridies eggs that died ranged from 45.7±2.7 to 100.0±0.0 % of specimens (***Fig. 6***).

The detrimental effect of disinfectants was accompanied by changes in the morphological structure of eggs in the form of: arrest in their development and loosening of the embryo (***Fig. 7 a***), destruction and loosening of the shell (***Fig. 7 b***), disintegration of the embryo and shell (***Fig. 7 c***), as well as the death of the larva at the stage of its formation in the egg (***Fig. 7 d***). In control test cultures, the formation of motile larvae in eggs was established (***Fig. 8***).

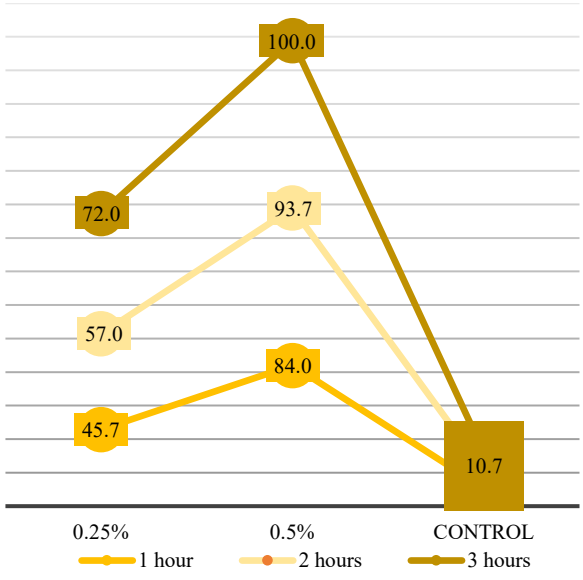

Fig. 6. Number of *Ascaridia galli* eggs (%) that died during their cultivation, under the influence of "Desirex Forte ParvoStop" and in the control test culture

It is known that ascaridiosis of chickens is one of the most common nematodoses of the digestive tract among poultry farms in the world, including in Ukraine [15–18]. Such a significant spread of helminthiasis among chickens is associated with the high resistance of ascarid eggs in the environment, which ensures constant reinfection of susceptible birds [19, 20]. Therefore, scientists are constantly conducting experimental studies to determine the disinvasive properties of disinfectants available on the veterinary market against *A. galli* eggs [11–13].

The conducted studies have established a high level of disinvasive efficiency against *A. galli* nematode eggs of modern disinfectants: "Krystal-900" – at 1.5 % concentration for exposures of 1 h, 2 h and 3 h (90.3 %, 94.0 % and 100.0 %, respectively); "Creolin" – at 4.0 % concentration for exposures of 2 and 3 h (92.9 and 100.0 %, respectively) and at 5.0 % concentration for all exposures (100.0 %); "Desirex Forte ParvoStop" – at 0.5 % concentration for exposures of 2 and 3 h (93.7 and 100.0 %, respectively). The detrimental effect of disinfectants was accompanied by changes in the morphological structure of eggs, which were characterized by a stop in their development and loosening of the embryo; destruction and loosening of the shell; disintegration of the embryo and shell, as well as the death of the larva.

There are separate reports that prove the high disinvasive activity of the disinfectant based on glutaraldehyde – "Hermecid-BC" against the eggs of *Heterakis*, which parasitize chickens. This agent showed a high level of ovicidal efficacy at 0.25 % and 0.5 % concentrations with exposures of 10–60 minutes 93.5–100.0 % [11].

The obtained research results allow us to recommend the disinfectants "Krystal-900", "Creolin" and "Desirex Forte ParvoStop" in specific application regimens for the effective control and prevention of ascaridiosis in chickens.

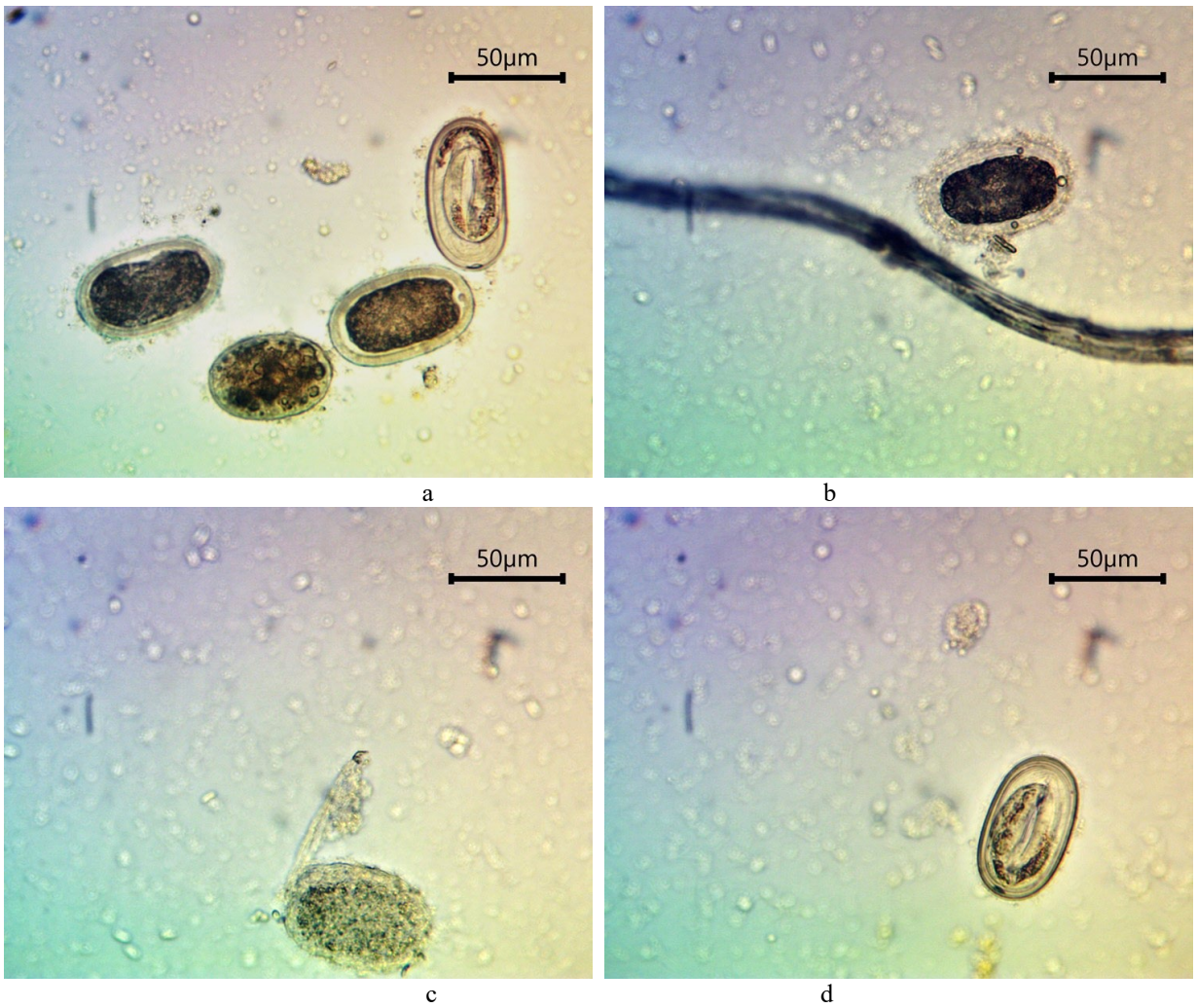

Fig. 7. Changes in *Ascaridia galli* eggs when exposed to disinfectants on experimental test cultures

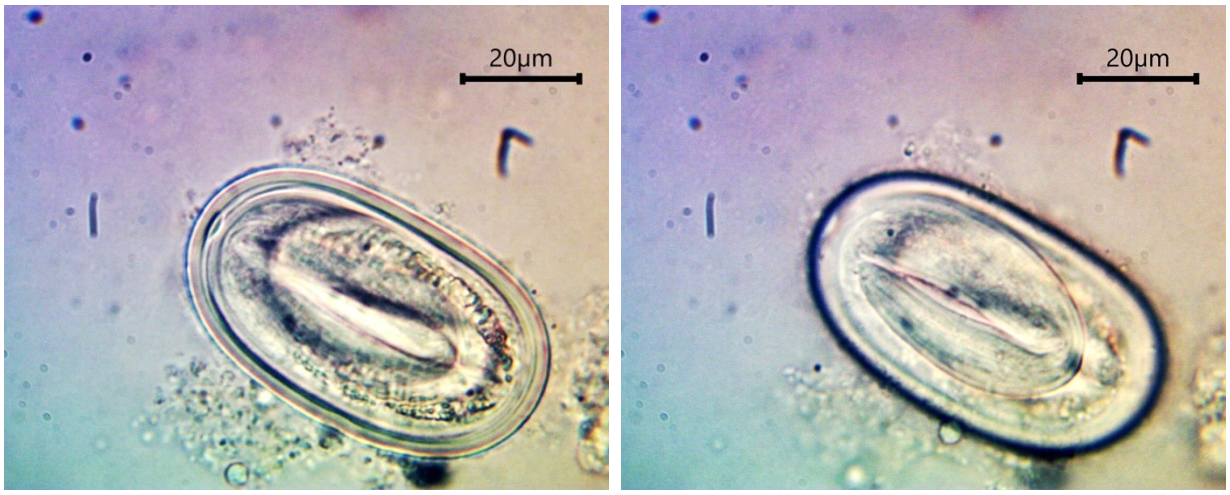

Fig. 8. Formation of motile larvae in *Ascaridia galli* eggs in a control test culture

Conclusions

The disinvasive properties of domestic disinfectants "Kristal-900", "Creolin" and "Desirex Forte ParvoStop" have been proven in relation to test cultures of *Ascaridia galli* eggs. A high level of disinvasive activity was established when using "Kristal-900" at a 1.5 % concentration for exposure of 1–3 hours (90.3–100.0 %); "Creolin" – at a 4.0 % concentration for exposure of 2–3 hours (92.9–100.0 %), at a 5.0 % concentration for exposure of 1–3 hours (100.0 %); "Desirex Forte ParvoStop" – at a 0.5% concentration for exposure of 2–3 hours (93.7–100.0%). The number of dead *Ascaridia galli* eggs ranged from 91.3 to 100.0 % when using

"Kristal-900", from 93.7 to 100.0 % when using "Creolin", and from 94.3 to 100.0 % when using "Desirex Forte ParvoStop".

Conflict of interest

The authors state that there is no conflict of interest.

References

1. You, M.-J. (2014). Suppression ofEimeria tenella Sporulation by Disinfectants. *The Korean Journal of Parasitology*, 52 (4), 435–438. https://doi.org/10.3347/kjp.2014.52.4.435
2. Cupo, K. L., & Beckstead, R. B. (2019). An *in vitro* assay of disinfectants on the viability of *Heterakis gallinarum* eggs. *Avian Diseases*, 63(3), 511–513. https://doi.org/10.1637/11952-081418-resnote.1
3. Yeresko, V. I. (2018). Dezinvaziini vlastyvosti khimichnoho zasobu «Dezsan» vidnosno invaziinykh yaiets zbudnykiv kapiliariozu husei. *Visnyk Sum-Skoho Natsionalnoho Ahrarnoho Universytetu. Seriia «Veterynarna Medytsyna»*, 1 (42), 158–161. [in Ukrainian]
4. Boyko, O., & Brygadyrenko, V. (2021). Nematicidal activity of essential oils of medicinal plants. *Folia Oecologica*, 48 (1), 42–48. https://doi.org/10.2478/foecol-2021-0005
5. Boyko, O., & Brygadyrenko, V. (2022). Nematicidal activity of inorganic food additives. *Diversity*, 14 (8), 663. https://doi.org/10.3390/d14080663
6. Paliy, A., Sumakova, N., Petrov, R., Shkromada, O., Ulko, L., & Palii, A. (2019). Contamination of urbanized territories with eggs of helmiths of animals. *Biosystems Diversity*, 27 (2), 118–124. https://doi.org/10.15421/011916
7. Papini, R., & Cacciuttolo, E. (2008). Observations on the occurrence of *Heterakis gallinarum* in laying hens kept on soil. *Italian Journal of Animal Science*, 7 (4), 487–493. https://doi.org/10.4081/ijas.2008.487
8. Bojar, H., & Kłapeć, T. (2018). Contamination of selected recreational areas in Lublin Province, Eastern Poland, by eggs of *Toxocara* spp., *Ancylostoma* spp. and *Trichuris* spp. *Annals of Agricultural and Environmental Medicine*, 25 (3), 460–463. https://doi.org/10.26444/aaem/92252
9. Maikai, B. V., Umoh, J. U., Ajanusi, O. J., & Ajogi, I. (2008). Public health implications of soil contaminated with helminth eggs in the metropolis of Kaduna, Nigeria. *Journal of Helminthology*, 82 (2), 113–118. https://doi.org/10.1017/s0022149x07874220
10. Simonato, G., Cassini, R., Morelli, S., Di Cesare, A., La Torre, F., Marcer, F., Traversa, D., Pietrobelli, M., & Frangipane di Regalbono, A. (2019). Contamination of Italian parks with canine helminth eggs and health risk perception of the public. *Preventive Veterinary Medicine*, 172, 104788. https://doi.org/10.1016/j.prevetmed.2019.104788
11. 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. https://doi.org/10.15421/0224100
12. Bessat, M., & Dewair, A. (2019). Assessment of the inhibitory effects of disinfectants on the embryonation of *Ascaridia columbae* eggs. *PLOS ONE*, 14 (5), e0217551. https://doi.org/10.1371/journal.pone.0217551
13. Bohach, M. V. (2007). Vyprobuvannia dezinfektantiv pry heterakoznii invazii indykiv. *Ahrarnyi Visnyk Prychornomor'ia*, 39, 85–88. [in Ukrainian]
14. Schou, T. W., & Permin, A. (2003). The effect of Stalosan F on selected poultry parasites. *Helminthologia*, 40 (1), 15–21.
15. Islam, K., Farjana, T., Begum, N., & Mondal, M. (2008). *In vitro* efficacy of some indigenous plants on the inhibition of development of eggs of *Ascaridia galli* (Digenia: Nematoda). *Bangladesh Journal of Veterinary Medicine*, 6 (2), 159–167. https://doi.org/10.3329/bjvm.v6i2.2330
16. Shohana, N. N., Rony, S. A., Ali, Md. H., Hossain, Md. S., Labony, S. S., Dey, A. R., Farjana, T., Alam, M. Z., Alim, Md. A., & Anisuzzaman. (2023). *Ascaridia galli* infection in chicken: Pathobiology and immunological orchestra. *Immunity, Inflammation and Disease*, 11 (9), e1001. https://doi.org/10.1002/iid3.1001
17. Höglund, J., Daş, G., Tarbiat, B., Geldhof, P., Jansson, D. S., & Gauly, M. (2023). *Ascaridia galli* - an old problem that requires new solutions. *International Journal for Parasitology: Drugs and Drug Resistance*, 23, 1–9. https://doi.org/10.1016/j.ijpddr.2023.07.003
18. Hlechyk, M. V. (2009). Osoblyvosti epizootolohii kyshkovykh parazytoziv kurei u Lvivskii oblasti. *Naukovyi Visnyk Lvivskoho Natsionalnoho Universytetu Veterynarnoi Medytsyny ta Biotekhnolohii imeni S. Z. Gzhytskoho*, 11 (2), 40–45.[in Ukrainian]
19. Sharma, N., Hunt, P. W., Hine, B. C., & Ruhnke, I. (2019). The impacts of *Ascaridia galli* on performance, health, and immune responses of laying hens: new insights into an old problem. *Poultry Science*, 98 (12), 6517–6526. https://doi.org/10.3382/ps/pez422
20. Bautista-Vanegas, A. L., Esteban-Mendoza, M. V., & Cala-Delgado, D. L. (2023). *Ascaridia galli*: A report of erratic migration in eggs for human consumption in Bucaramanga, Colombia - case report. *Arquivo Brasileiro de Medicina Veterinária e Zootecnia*, 75 (1), 122–126. https://doi.org/10.1590/1678-4162-12818

ORCID

V. Melnychuk https://orcid.org/0000-0003-1927-1065
O. Kovalenko https://orcid.org/0000-0001-5897-4797
V. Yevstafieva https://orcid.org/0000-0003-4809-2584
A. Zamaziy https://orcid.org/0000-0003-3138-0424
O. Dolhin https://orcid.org/0000-0003-0368-317X