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The current state of development and veterinary support of pheasant farming in Ukraine

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Abstract

The results of the research established that Ukraine has sufficient resources for the intensification of the development of artificial breeding of game, the formation of a network of game nurseries, the use of which will contribute to the development of infrastructure and the solution of several social and economic issues of the activity of territorial communities, the development of environmental education and culture. Considering the state and specificity of the field of pheasant farming, where it is currently located, the introduction into practice of new methods and means of preventing and treating poultry diseases remains relevant. Kolidev 8M is an antimicrobial veterinary drug based on colistin for intestinal infections. One gram of the drug contains the active colistin sulfate – 8,000,000 IU and auxiliary substances: glucose and citric acid. The medicinal product is used for the treatment of European fallow deer (up to 3 months of age) and decorative birds (pheasant, peacock) for diseases of the digestive tract (colibacteriosis, salmonellosis, pasteurellosis) caused by microorganisms sensitive to colistin. According to the results of clinical and biochemical studies, it should be noted that the use of the veterinary drug "Kolidev 8M" (powder for oral use) in the antibacterial therapy of pheasants did not cause hemo-, nephro- and hepatotoxic effects in the body of the target bird. Pheasants tolerated the veterinary drug "Kolidev 8M" (powder for oral use) well; no adverse reactions were observed during the experiment. After proper registration, the developed antibacterial drug "Kolidev 8M" can enter a veterinarian's arsenal as an effective and safe drug for the antibacterial diseases of pheasants. Further research will be aimed at the development and state registration of the water-soluble powders "Amoksidev 60" and "Doksidev". Antibacterial drugs will be prescribed to treat and prevent diseases of the respiratory and digestive systems of pheasants caused by microorganisms sensitive to the action of the drugs (amoxicillin trihydrate and doxycycline hyclate).

Keywords: pheasant; clinical trials; veterinary drug; powder for oral use; "Kolidev 8M", bacterial disease.

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1. Introduction

To date, a significant reduction in the quantitative and qualitative composition of hunting resources has been observed in Ukraine, which is associated with a significant anthropogenic burden on the habitat of fauna, a low level of provision, and crisis processes in the development of the economy (Korzh et al., 2012; Pepko et al., 2023). One of the leading roles in the decline of Ukrainian domestic hunting is played by the presence of this industry under the leadership of non-core state institutions and the insufficient provision of the industry with highly qualified personnel. To a large extent, the negative impact on the condition of field game is due to the use of high-tech methods of soil cultivation and the transition to monoculture agrolandscapes, which resulted in the elimination of autochthonous miniature mosaic landscapes.

One of the promising objects of artificial game breeding is the common pheasant (Phasianus colchicus L, 1758) (Baratti et al., 2001; Gomes et al., 2005), the target population of which is formed in the southern, eastern, and central regions of Ukraine, as well as in Transcarpathia.

Ukraine has sufficient natural, climatic, and economic resources for creating and operating a pheasantry network to

implement zootechnical measures, including zootechnical, biotechnical, and hunting components (Korzh et al., 2012).

The experience of European countries shows the need to use artificial game breeding measures to restore the population of this species (Liu et al., 2019; He et al., 2021; Ashrafzadeh et al., 2021, 2023). In particular, in 1952, the number of peasants in Bulgaria was 2.5 thousand individuals. Thanks to the annual release of 100,000 heads. Of birds in 20 years, the number of removed livestock was 80,000. In the 80s of the 20th century, the number of pheasants increased to 350,000, the annual release was up to 450,000, and the shooting was about 200,000 individuals (Korzh et al., 2012).

In Hungary, work on the artificial breeding and release of pheasants into the fields began in the 60s of the 20th century. In 1977, over a million birds were shot, four times more than in the late 1960s. At the end of the 1970s, annual releases amounted to about 1 million heads of pheasant. The most important factor affecting the number of livestock is the change of the habitat due to the activities of the agro-industrial complex enterprises, as well as the impact of predators and the epizootic condition (Sugár et al., 1996).

In addition, the effect of the new drug "Kolidev 8M" in diseases of the digestive organs of pheasants remains insufficiently studied.

The work aims to consider the prospects and the main modern trends in developing pheasant farming in Ukraine and to conduct a clinical trial of the drug "Kolidev 8M" (powder for oral use) on pheasants.

2. Materials and methods

The results of modern scientific research in artificial game breeding, particularly the common pheasant, statistical data of the State Statistics Service of Ukraine, prerequisites, and prospects for the development of pheasant farming are analyzed.

The work uses a new development of "DEVIE" LLC – an antibacterial drug of domestic production Kolidev 8M (powder for oral use) – hygroscopic powder from white to light yellow color.

One gram of the drug contains the active substance colistin sulfate – 8,000,000 IU and auxiliary substances: glucose and citric acid.

Pharmacological properties. ATS vet classification code QA07 – antimicrobial veterinary drugs used in intestinal infections. QA07AA10 – Colistin.

Colistin (polymyxin E) is a natural antibiotic of the polypeptide group produced by the aerobic spore-forming bacillus Bacillus polymyxa var Colistinus. The drug has a bactericidal effect on gram-negative bacteria (*Escherichia coli, Salmonella* spp., *Shigella* spp., *Proteus* spp., *Pseudomonas aeruginosa, Klebsiella pneumoniae, Pasteurella* spp., *Haemophilus* spp., *Bordetella* spp.).

Gram-positive bacteria and some gram-negative bacteria, for example, *Serratia* spp. and *Proteus* spp., are naturally resistant to colistin. However, the acquired resistance of gram-negative bacteria of the intestinal group to colistin is rare.

The mechanism of action of colistin consists in breaking the permeability of the cytoplasmic membrane of microorganisms. Colistin binds to the membrane's phospholipids, increasing its permeability tooth internal and external cellular components, which destroys the bacterial cell. In addition, colistin also binds phospholipid A and neutralizes the biological effect of bacterial endotoxin.

After oral administration, colistin, to a small extent, is absorbed from the alimentary canal of the European doe (age up to 3 months). Its content in the blood serum of this species of animals was not detected. In the serum of chickens of ornamental birds, colistin was observed in insignificant concentration 6 hours after application with drinking water.

Colistin does not accumulate in organs and tissues; it is excreted from the body mainly unchanged with feces, but a small amount is also excreted with urine. The level of removal is mainly 90–99 %.

The drug is used for the treatment of European fallow deer (up to 3 months of age) and decorative birds (pheasant, peacock) for diseases of the digestive tract (colibacteriosis, salmonellosis, pasteurellosis) caused by microorganisms sensitive to colistin.

Dosage. It is used orally with drinking water or with feed (withstands granulation) in doses:

- European doe (up to 3 months of age) – 0.01 g of the drug per 1 kg of the animal's body weight (or 80,000 IU of colistin sulfate per 1 kg of the animal's body weight);
- ornamental birds (pheasants, peacocks) – 0.008–0.01 g of the drug per 100 kg of animal body weight (or 64,000-80,000 IU of colistin sulfate per 1 kg of animal body weight).

The course of treatment is five days.

Contraindication. Do not use in animals with hypersensitivity to colistin or in animals with kidney disease.

Do not use it for prevention!

The absorption of colistin can be reduced due to the increased content of Ca2+, Fe3+, and Mg2+, as well as unsaturated fatty acids in animal feed.

Do not use antacids, kaolin, drugs containing unsaturated fatty acids, ammonium compounds, and Mg2+, Ca2+, and Ba2+ cations simultaneously, as the latter inhibits the action of colistin.

Do not use simultaneously with other antimicrobial drugs.

Caveat. Side effect is not established.

Special precautions for use. When using the drug, generally accepted principles regarding the use of antimicrobial drugs should be taken into account. It should be considered that colistin is prescribed in humane medicine for treating infections caused by multiresistant microorganisms. Therefore, it should be used only considering the testing results for the sensitivity of microorganisms. The use of drugs violating the instructions given in the leaflet can lead to an increase in the number of bacteria resistant to it and a decrease in the effectiveness of treatment with other antimicrobial drugs due to cross-resistance.

Use during pregnancy and lactation.

No reservations.

Interaction with other means and other forms of interaction.

Do not use simultaneously with other antimicrobial drugs.

Do not use antacids, kaolin, drugs containing unsaturated fatty acids, ammonium compounds, and Mg2+, Ca2+, and Ba2+ cations simultaneously, as the latter inhibits the action of colistin.

Release form. Polymer bags of 100 and 250 g.

Storage. A dark, inaccessible place for children, at temperatures from 8 ºC to 15 ºC. Do not freeze.

The shelf life is two years.

After dissolving in water, the solution must be used within 18 hours.

After the first opening of the package, the drug must be used within four months.

For use in veterinary medicine!

Owner of the registration certificate: PP "Biopharm", 22300, Vinnytsia region, Litynskyi district, village Lityn, str. Bohdan Khmelnytskyi, 37, Ukraine.

Manufacturer of the finished product: "DEVIE" LLC, 22300, Vinnytsia region, Litynsky district, village Lityn, str. Bohdan Khmelnytskyi, 37, Ukraine.

Clinical studies of the drug "Kolidev 8M" on pheasants were carried out in the conditions of the aviary of the OSH of the Rivne district of the Rivne region. To establish the etiological structure and epizootological features of the spread of digestive tract infections, a clinical and epizootological examination, and patho-anatomical and bacteriological studies were carried out.

Laboratory tests of animal blood were carried out based on the laboratory for quality control, safety, and registration of veterinary medicinal products and feed additives of "DEVIE" LLC using ImmunoChem-2100 equipment – a multifunctional microplate photometer; Immunochem-2200-2 – thermal shaker for two tablets and a set of reagents of the company "Filisit-Diagnostika".

In 3-month-old pheasants, depression, signs of intoxication, refusal of feed, digestive disorders, and death within 2-3 days were noted.

At the autopsy, serous-fibrinous pericarditis, fibrinous perihepatitis, fibrin deposits on serous coverings, peritonitis, aerosacculitis, hemorrhagic diathesis, acute catarrhal enteritis, spleen enlargement were noted.

The diagnosis was established based on epizootological data, clinical signs and patho-anatomical changes, and isolation of the causative agent during bacteriological studies.

The death rate of pheasants was 4 %, the morbidity rate was 12 %.

The therapeutic effectiveness of the drug "Kolidev 8M" was determined in 2 experimental groups (n = 5), clinically ill pheasants aged three months, which were selected according to the principle of analogs: 1 experimental group, with drinking water, drank the drug "Kolidev 8M" (powder for oral application) at the rate of 1.5 g per 10 liters of drinking water per day; 2 research group, with drinking water, drank the analog drug "KOLIN 5" (powder for oral use), at the rate of 125 g per 1000 l of water per day. The drugs were drunk for five days. The period of observation of pheasants was 21 days.

Clinical studies of the veterinary medicinal product were conducted considering the Guidelines for Clinical Studies of Veterinary Medicines on Target Animal Species and the requirements outlined in the publication "Clinical Studies of Veterinary Medicines and Feed Additives" (Kotsiumbas et al., 2013; Gutyj et al., 2017; Vasylyev et al., 2021; Martyshuk et al., 2022).

3. Results and discussion

Artificial game breeding, particularly pheasant farming, in Ukraine, compared to Western European countries, is a poorly developed field of activity.

According to the State Statistics Service of Ukraine, during 2016, 2017, 2019, and 2020, the number of pheasants kept in game nurseries increased from 4,870 heads to 6,252 goals (Fig. 1). The business output of young pheasants during 2016-2017 amounted to 4,466 and 5,567 heads, respectively (Fig. 1). The number of birds released into the territory continues to grow (increases from 13,336 to 14,591).

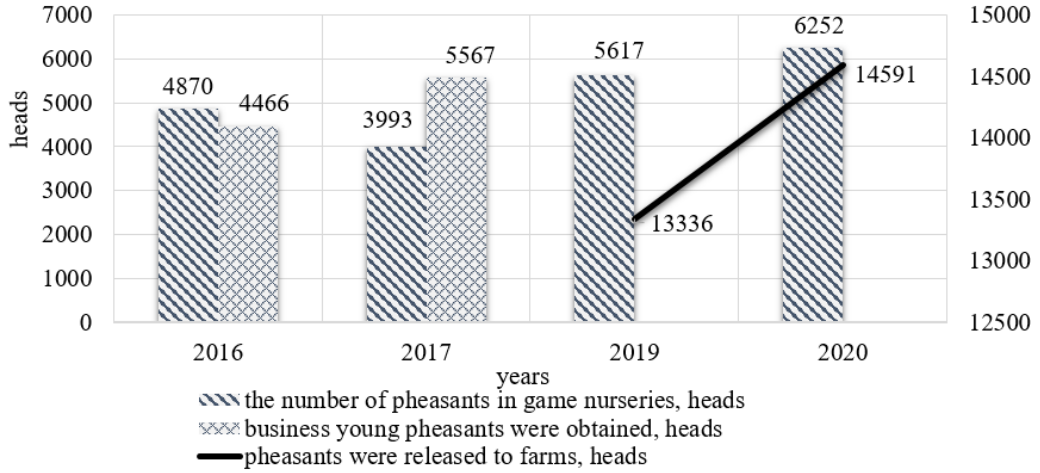

Fig. 1. Dynamics of the number of common pheasants, which were kept in game nurseries, the release of commercial young animals and the release of pheasants into the land, goal

The largest game nurseries in terms of the number of pheasant populations are located in the Kharkiv, Dnipropetrovsk, Kyiv, Zhytomyr, and Poltava regions (according to the statistical bulletin "Hunting Management in 2017").

To create a network of pheasants with different technological processes and production volumes, it is necessary to organize the production of standardized complete feed additives for hunting pheasants of different age groups and productivity.

In addition, taking into account the state and specificity of the field of pheasant farming, in which it is currently located, the introduction into practice of new methods and

means of preventing and treating poultry diseases remains relevant.

Given that medicinal products for pheasants must be registered for veterinary use by the procedure defined by legislation, clinical trials are a mandatory stage in developing medicinal products.

The clinical trial of "Kolidev 8M" showed that antibiotic therapy improved the bird's general condition on the fourth day: pheasants became active, appetite appeared, and the function of the digestive tract normalized on the fifth day. Death stopped on the second week of the experimental period (Table 1).

The level of preservation in the first and second experimental groups of pheasants decreased to 93 % and 92 %, relative to the initial values, and was higher by 23% compared to the control group. Meanwhile, in the control group of animals, survival decreased by 11 %.

The results of clinical and biochemical blood tests of experimental pheasants before and after antibacterial therapy are shown in Tables 2 and 3.

Table 1

Evaluation of the therapeutic effectiveness of the drug "Kolidev 8M" on pheasants, %

Indicator	Group			
	Observation period	1 experiment	2 experiment	Control
Presence of clinical signs, percentage	1st week of observation	100.0	100.0	100.0
	2nd week of observation	28.0	31.0	89.0
	3rd week of observation	are missing	are missing	83.0
Conservation of livestock, percentage	1st week of observation	96.0	95.0	81.0
	2nd week of observation	94.0	93.0	76.0
	3rd week of observation	93.0	92.0	70.0

Table 2

The level of hematological indicators in the blood of pheasants before and after antibacterial therapy (M ± m; n = 5)

Group of birds	Research term, day	
	Before antibacterial therapy (control)	On the sixth day from the start of antibacterial therapy
Total hemoglobin (HGB), g/L		
1 experiment	96.25 ± 3.13	125.38 ± 3.14*
2 experiment	98.18 ± 2.71	125.90 ± 3.78*
Reference level	110 – 150	
Erythrocytes (RBC), T/L		
1 experiment	3.72 ± 0.16	3.78 ± 0.18
2 experiment	3.74 ± 0.41	3.65 ± 0.12
Reference level	2,1 – 4,9	
Leukocytes (WBC), G/L		
1 experiment	34.42 ± 1.53	26.14 ± 1.54*
2 experiment	35.05 ± 1.84	26.06 ± 1.33*
Reference level	19 – 29	

Notes here and further in all tables: 1st experiment – a first experimental group of birds (animals), which were given the drug "Kolidev 8M"; II experiment – II experimental groups of birds (animals), which were prescribed the analog drug "KOLIN 5"; * – the difference in the values of the indicated indicators is probable at ($P \leq 0.05$) relative to the values of the corresponding indicators in the control (before antibacterial therapy).

Research has established (Table 2) that the clinical picture of the disease of the experimental bird of the first and second experimental groups was accompanied by changes in the hematological indicators of its blood: a decrease in the level of total hemoglobin and an increase in the number of leukocytes, which on average was 26.0 and 24.5 % ($P \leq 0.05$) and 43.4 and 46.0 % ($P \leq 0.05$) relative to the physiological values of the indicators, which collectively indicates the presence of inflammatory reactions in the body of the sick bird.

Using both antibacterial drugs in treating pheasants led to normalizing hematological indicators. Thus, on the sixth day of research in the blood of pheasants of the first and second experimental groups, the level of total hemoglobin increased, on average, by 30.3 and 28.2 % ($P \leq 0.05$), and the number of leukocytes – decreased by 24.1 and 25.6 % ($P \leq 0.05$), respectively, relative to the control level of indicators.

Table 3 shows the results of determining biochemical parameters in the blood serum of pheasants before and after antibacterial therapy. It was established that in pheasants of the I and II research groups, with clinical signs of the disease, the content of total proteins in blood serum was increased, on average, by 27.1 and 25.8 % ($P \leq 0.05$), relative to the average values of its reference level. An increase in the enzymatic activity of ALT and AST, which averaged 225.0 and 196.9% ($P \leq 0.05$) and 21.1 and 19.7 % ($P \leq 0.05$), respectively, relative to the reference values of the indicators.

The use of antibacterial drugs "Kolidev 8M" (1 experiment) and the analog drug "KOLIN 5" (2 experiments) led to the restoration of the level of indicators in the blood serum of pheasants: the decrease in total proteins was on average 10.7 and 10.5 % ($P \leq 0.05$), and the enzymatic activity of ALT and AST – 66.3 and 62.1 % ($P \leq 0.05$) and 16.1 and 12.3 % ($P \leq 0.05$), respectively, relative to their control values (before antibiotic therapy).

Table 3
The level of biochemical parameters in blood serum of pheasants before and after antibacterial therapy (M ± m; n = 5)

Group of birds	Indicator value
Total proteins, g/L	
Before treatment (control):	
1 experiment/2 experiments	60.38 ± 3.34/59.75 ± 2.63
1 experiment	53.90 ± 2.36*
Two experiments	53.45 ± 1.60*
Reference level	39.0 – 56.0
Glucose, mmol/L	
Before treatment (control):	
1 experiment/2 experiments	3.89 ± 0.21/3.92 ± 0.19
1 experiment	3.96 ± 0.25
2 experiment	4.02 ± 0.33
Reference level	3.50 – 5.40
ALT activity, μmol/h cm^3	
Before treatment (control):	
1 experiment/2 experiments	1.04 ± 0.06/0.95 ± 0.03
1 experiment	0.35 ± 0.02*
2 experiment	0.36 ± 0.03*
Reference level	0.27 – 0.37
AST activity, μmol/h cm^3	
Before treatment (control):	
1 experiment/2 experiments	5.16 ± 0.35/5.10 ± 0.28
1 experiment	4.33 ± 0.27*
2 experiment	4.47 ± 0.41*
Reference level	3.71 – 4.81

It was established that the values of indicators of the number of erythrocytes and glucose content in the blood of pheasants before and after antibacterial therapy were within their reference level.

Based on the results of clinical and biochemical studies, it should be noted that the use of the veterinary drug "Kolidev 8M" (powder for oral use) in the antibacterial therapy of pheasants did not cause hemo-, nephro- and hepatotoxic effects in the body of the target bird. Pheasants tolerated the veterinary drug "Kolidev 8M" (powder for oral use) well; no adverse reactions were observed during the experiment.

After proper registration, the developed antibacterial drug "Kolidev 8M" can enter a veterinarian's arsenal as an effective and safe drug for the antibacterial diseases of pheasants.

4. Conclusions

Ukraine has sufficient resources for intensifying the development of artificial game breeding and the formation of a network of game nurseries, the use of which will contribute to the development of infrastructure and the solution of several social and economic issues of the activities of territorial communities, the development of environmental education and culture.

Based on the results of clinical and biochemical studies, it should be noted that the use of the veterinary drug "Kolidev 8M" (powder for oral use) in the antibacterial therapy of pheasants did not cause hemo-, nephro- and hepatotoxic effects in the body of the target bird. Pheasants tolerated the veterinary drug "Kolidev 8M" (powder for oral use) well, and adverse reactions were not observed during the period of the experiment.

Prospects for further research. Further research will be aimed at the development and state registration of the water-soluble powders "Amoksidev 60" and "Doksidev". Antibacterial drugs will be prescribed to treat and prevent diseases of the respiratory and digestive systems of pheasants caused by microorganisms sensitive to the action of the drugs (amoxicillin trihydrate and doxycycline hyclate).

Conflict of interest

The authors declare that there is no conflict of interest.

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