

NATURAL REMEDIES USED IN FIGHTING ECTOPARASITES IN GALLINACEOUS BIRDS

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Abstract

The scientific paper elucidates the importance of using remedies of natural origin, compared to those of chemical origin, in combating ectoparasites in gallinaceous birds. For the first time, the antiectoparasitic efficacy of the natural extract Ectogalimol, obtained from the plant raw material, dry aerial parts of the Dalmatian chamomile (Pyrethrum cinerariifolium Trev.) which in a concentration of 3%, administered by spraying in two rounds at an interval of 14 days, in a dose of 50 ml per bird, possesses a high therapeutic effectiveness against the various species of ectoparasites (bird lice, fleas and gamasid mites). For comparative purposes, the drug Ivermec-OR is used, which also possesses a high antiparasitic efficacy against various species of bird lice, fleas and gamasid mites in gallinaceous birds, compared to the natural extract Ectogalimol, which does not require restrictions on the consumption of products and by-products from treated birds.

Key words: antiparasitic drug, ectoparasites, gallinaceous birds, natural remedy.

INTRODUCTION

The prevention and treatment of parasitosis in animals is generally achieved by dehelminthisation with chemical compounds, which affect not only the parasites, but also the host. In this context, it is very important to identify natural remedies with an antiparasitic effect. The practice has shown that the remedies of plant origin have a number of advantages over synthetic ones: in addition to being produced from accessible and cheap raw materials, they are not toxic to the host, can be used by free-feeding, and the use of products obtained from treated animals have no restrictions in consumption. Herbal medicines, used since ancient times, have not lost their importance even today and are applied in the treatment of various disorders of the cardiovascular, nervous, digestive system and last but not least, as anti-parasitic preparations. Some plant compounds have been found to

have medicinal properties with antibacterial, antiparasitic and antifungal effects (Olteanu et al., 2001; Ciucă, 2002; Erhan, 2020; Rusu et al., 2011; 2020; 2021).

The use of natural insecticides such as pyrethrin extracted from pyrethrum flowers (*Chrysanthemum cinerariaefolium*), is part of the objectives of sustainable agriculture to reduce the incidence of pests and the diseases caused by them without producing any change in the natural balance (Kinz & Kemp, 1994; Schleier & Peterson, 2011; Gupta & Shah, 2013; Campos et al., 2019).

Some authors reveal that the development and production of safer and naturally preferred insecticides is an important objective. Pyrethrins are natural insecticides biosynthesized from the pyrethrum plant [*Chrysanthemum cinerariaefolium* (current species name: *Tanacetum cinerariifolium*)] of the Asteraceae family. Pyrethrum (*Chrysanthemum cinerariaefolium*) is a small

perennial plant grown commercially for the extraction of natural pyrethrins used in the manufacture of insecticides. These are known for their rapid destruction and lethal action on a wide range of insect pests (Maciver, 1995; Hitmi et al., 2000; Anadón, 2009; Chen et al., 2018; Markhamet et al., 2020;).

Therefore, pyrethrins are ideal substitutes for synthetic insecticides. Natural pyrethrin insecticides produced from *Tanacetum cinerariifolium* have been shown to have toxicity for mammals and short persistence in the environment, providing an alternative to widely used synthetic insecticides that pose a threat to human health and the environment (Bhat & Menary, 1986; Bodrug, 2004; Freemont, 2016; Lybrand et al., 2020; Jeran et al., 2021).

In 2015, Campbell & Omura were awarded the Nobel Prize in Physiology and Medicine for the development of Ivermectin and the development of "new treatments for diseases caused by nematodes".

Another antiparasitic preparation with a broad spectrum of action, recommended to combat some groups of ecto and endoparasites in birds and mammals, which is part of the group of macrocyclic lactones, is Ivomec. It has the

property of irreversibly blocking neuromuscular transmission, acting at the level of synapses, thus stimulating gamma-aminobutyric acid (GABA), which is an inhibitor of nerve stimuli (Cernea et al., 2006). Avermectins are produced by the soil microorganism *Streptomyces avermitilis*. A complete study of the bacterium's genome was completed in 2003. Avermectins were first isolated and identified in 1976 in Japan. *Streptomyces avermitilis* culture produces four main forms of avermectins - A₁, A₂, B₁, B₂ and each component has two isomeric forms: a and Ivermectin and Abamectin, members of the Avermectin family of compounds, were introduced to the market in the 1980s as a veterinary antiparasitic drug and an agricultural pesticide, respectively. Their acceptance and commercial success were remarkable; both are highly effective and used worldwide (Campbell, 1989).

The avermectin complex, obtained from the mycelium of *Streptomyces avermitilis* VKPM S-1440 containing the group B – 67.8-77.4% was named Avertin N – practically an analogue of Aversectin-C, which differs only in the strain of the producer (Ardelean, 1999) (Table 1).

Table 1. Physical and chemical properties of the antiparasitic drug Ivomec

Chemical properties	
Formula	C ₄₈ H ₇₄ O ₁₄ (22,23-dihydroavermectin B = 1a) C ₄₇ H ₇₂ O ₁₄ (22,23-dihydroavermectin B = 1b)
Molecular mass	875,10 g / mol (B = 1a) 861,08 g / mol (B = 1b)
Physical properties	
Difusin temperature	155 ° C
Solubility	Insoluble

The antiparasitic drug Ivomec OR, being of chemical origin, has a broad spectrum of action against ecto- and endoparasites in gallinaceous birds. It is active against ticks, bird lice, fleas, bed bugs, feather mites – scaly leg mite (*Cnemidocoptes mutans*), depluming mite (*Cnemidocoptes levis*) and fowl cyst mite (*Laminosioptes cisticola*) with localization in the subcutaneous connective tissue and muscles. The product also acts on parasitic nematodes: *Ascaridia* spp., *Capillaria* spp., *Syngamus tracheae*, *Trichostrongylus* spp., *Heterakis gallinarum*, etc.

One of the primary social problems in the Republic of Moldova is providing the population with dietary food products: meat, milk, eggs, etc. Along with the continuous growth of the population, the consumption of proteins of animal origin also increases (Tomşa & Bondoc, 2014).

The evolution of diseases in humans and animals, in general, but in particular zoonoses, causes incalculable damage through loss of human and animal lives, through the transition to incapacity of work for some people, and low productions and confiscation of carcasses and organs in animals.

Numerous authors reveal the evolution of zoonoses, the importance of natural outbreaks and the role of birds as vectors, especially migratory ones, which can transport parasites and microbes over long distances (Toderaş & Movilă, 2008; Zamornea et al., 2022).

Currently, new ecological solutions are needed to obtain and use ectoparasiticides in the control of ectoparasitoses in animals. The interest of the prophylaxis and treatment of ectoparasitic agents with the help of the use of natural ectoparasiticides does not leave without interest even parasitologists from the Republic of Moldova (Zamornea et al., 2021).

MATERIALS AND METHODS

In the antiparasitic therapy of gallinaceous birds, a new drug of vegetable origin was used in different concentrations - Ectogalimol developed in the Laboratory of Parasitology and Helminthology of the Institute of Zoology in collaboration with the Center of Advanced Biological Technologies within the Institute of Genetics, Physiology and Plant Protection (Rusu Ş. et.al. 2008).

To evaluate the effectiveness of the drug Ectogalimol against bird lice, fleas and gamasid mites, 6 experimental batches of 10 Adler Silver chickens aged 4 months and 6 batches of 10 pheasants (*Phasianus colchicus* L.), aged 4 months, spontaneously infested with ectoparasites were selected. In order to establish the diversity of the parasitic fauna, bird lice, fleas and gamasid mites were collected from live birds, according to a new procedure for collecting the ectoparasites from live birds according to the method described by Rusu Ş. et al. 2021. The collected material was subsequently examined with the help of the MBC-9 stereo microscope (ob. x 4) and the МБИ -3 microscope (ob. x 10). Extensivity of invasion (EI) and intensity of invasion (II) with ectoparasites were determined in chickens and common pheasants.

The drug of vegetable origin - Ectogalimol was used in comparison with one of chemical origin - Ivermec-OR, which is a product registered in the Republic of Moldova and placed on the website of the National Agency for Food Safety (ANSA) in the compartment "Nomenclature of pharmaceutical products for veterinary use".

Infected birds were divided into groups (chickens and pheasants), which were maintained in separate places with free access to food and water. The naturally infested gallinaceous bird groups were treated with the antiparasitic drugs Ectogalimol and Ivermec-OR. The natural extract obtained from the Dalmatian chamomile (*Pyretrum cinerariifolium* Trev.) - Ectogalimol was used for research in the form of an aqueous solution in concentrations of 1%, 2%, 3%, 4% and 5%. The application of the medication Ectogalimol was carried out by spraying each bird separately in a dose of 50 ml in two rounds at an interval of 14 days. The antiparasitic drug Ivermec-OR was administered orally, 0.4 ml of medicine per 1 kg of weight, in three rounds: two administrations were given at an interval of 24 hours, and the last administration was carried out on the 14th day since the last application.

The drug Ectogalimol is a natural, biologically active extract obtained from the plant raw material, dry aerial parts of Dalmatian chamomile (*Pyretrum cinerariifolium* Trev.), the active substance being Pyrethrin. The medication Ectogalimol was obtained in the laboratory of Parasitology and Helminthology of the Institute of Zoology by the following procedure: 500 g of dry aerial parts of Dalmatian chamomile (*Pyretrum cinerariifolium* Trev.) were subjected to extraction with the alcoholic-aqueous solution of 60% in the ratio 1:4 on the refrigerated circulating baths for 8 hours. The procedure is repeated in three rounds, and the extract obtained after filtration was distilled to dryness in a vacuum evaporator at 50°C. Thus, obtaining 38.7 g of dry residue rich in biologically active substance. The verification of the obtained product was carried out with the help of the chromatograph placed in a thin layer on «Silufol» plates in the solvent system «chloroform:methanol» = 75:25 (v/v).

RESULTS AND DISCUSSIONS

In order to determine the effective dose and the harmlessness of the natural extract Ectogalimol, 6 groups of 4 month old Adler Silver chicks of 10 specimens each, spontaneously infested with various species of

ectoparasites were formed: bird lice - *Cuclotogaster heterographus*, *Eomenacanthus stramineus*, *Goniocotes gallinae*, *Goniocotes maculatus*, *Goniodes dissimilis*, *Lipeurus caponis*, *Menopon gallinae*, *Menacanthus cornutus*, *Menacanthus pallidulus*; fleas - *Ceratophylus gallinae*, *C. hirundinis* and gamasid mites - *Dermanyssus gallinae*, *D. hirundinis*).

In the antiparasitic therapy, the natural extract Ectogalimol was applied, which was used for

research in aqueous solutions in concentrations of 1%, 2%, 3%, 4% and 5%.

Group I – control (infested, untreated), Group II – treated with Ectogalimol 1%; Group III - Ectogalimol 2%; Group IV - Ectogalimol 3%; Group V - Ectogalimol 4% and Group VI – Ectogalimol 5%.

The application of the drug Ectogalimol was carried out by spraying each bird with a dose of 50 ml.

The obtained results are presented in Table 2.

Table 2. The effectiveness of the drug Ectogalimol in various doses and periods of time

Group No.	No. of chickens	The concentration of the drug, (%)	The effectiveness of the drug after administration (%)			
			2 hours	12 hours	24 hours	72 hours
I	10	control	-	-	-	-
II	10	1	0	10	30	40
III	10	2	30	40	60	70
IV	10	3	90	100	100	100
V	10	4	100	100	100	100
VI	10	5	100	100	100	100

Each group of birds was kept isolated in separate spaces. The effectiveness of the drug, administered in various doses, was determined over 2, 12, 24 and 72 hours after the treatment. The results of the conducted research demonstrate that, in groups II and III, where Ectogalimol with a concentration of 1% and 2% was used, a low effectiveness of this drug was established (40% and 70%, respectively), and in groups IV, V and VI where a concentration of 3%, 4% and 5% was applied, a maximum therapeutic efficacy (100%) was registered. Since Ectogalimol in concentrations of 3%, 4% and 5% has the same therapeutic efficacy - 100%, to combat ectoparasites in chickens, Ectogalimol in a concentration of 3% is recommended.

It was found that the Ectogalimol 3% administered to chickens has a high therapeutic effectiveness against various species of ectoparasites in chickens: bird lice - *Cuclotogaster heterographus*, *Eomenacanthus stramineus*, *Goniocotes gallinae*, *Goniocotes maculatus*, *Goniodes dissimilis*, *Lipeurus caponis*, *Menopon gallinae*, *Menacanthus cornutus*, *Menacanthus pallidulus*; fleas -

(*Ceratophylus gallinae*, *C. hirundinis*) and gamasid mites - *Dermanyssus gallinae*, *D. hirundinis*). The clinical condition of the chickens after the treatment has improved, the birds calmed down, the appetite increased.

Thus, as a result of the administration of the drug Ectogalimol 3%, there was a considerable decrease of the extensivity of invasion with ectoparasites - up to 100%. The medication Ectogalimol 3% is not toxic, for these reasons the overdose does not produce adverse effects and does not require high costs and a large volume of work. The curative therapy consists in the application by spraying of the aqueous solution of Ectogalimol 3% in two rounds at an interval of 14 days, in a dose of 50 ml per bird. The prophylaxis is carried out by spraying the aqueous solution of Ectogalimol 3% in a dose of 50 ml per bird, in a single dose of clinically healthy birds from contaminated households. It is recommended to disinfect the surface of the shelters, both inside and outside, using the aqueous solution of Ectogalimol 3%, in two doses, at an interval of 14 days, simultaneously with the deparasitation of birds. The obtained results are presented in Figure 1.

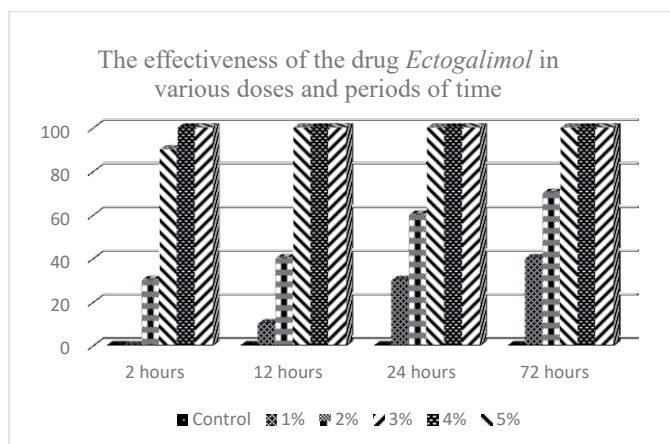


Figure 1. The effectiveness of the drug Ectogalimol in various doses and periods of time

At the same time with the testing of the antiparasitic effectiveness of the natural medication Ectogalimol, the testing of the effectiveness of Ivermec OR in combating ectoparasites in gallinaceous birds was also carried out. For this purpose, 2 groups of birds were formed.

Group 1 consisted of 10 pheasants (aged 4 months) spontaneously infested with bird lice (*Cuclotogaster cinereus*, *Cuclotogaster heterographus*, *Goniocotes chrysocephalus*, *Goniocotes microthorax*, *Goniodes colchici*, *Goniodes dissimilis*, *Lipeurus caponis*, *Menacanthus stramineus*, *Menopon gallinae*), fleas (*Ceratophylus gallinae*, *Ceratophylus hirundinis*) and gamasid mites (*Dermanyssus gallinae*, *Dermanyssus hirundinis*).

Group 2 consisted of 10 specimens of 4-month-old Adler Silver chicks spontaneously infested with ectoparasites: bird lice - *Cuclotogaster heterographus*, *Eomenacanthus stramineus*, *Goniocotes gallinae*, *Goniocotes maculatus*, *Goniodes dissimilis*, *Lipeurus caponis*, *Menopon gallinae*, *Menacanthus cornutus*, *Menacanthus pallidulus*; fleas - (*Ceratophylus gallinae*, *C. hirundinis*) and gamasid mites - *Dermanyssus gallinae*, *D. hirundinis*)

In the antiparasitic therapy, the drug Ivermec OR was applied according to the administration leaflet. Ivermec-OR has a high efficacy against ectoparasites previously detected in gallinaceous birds (Gherman et al., 2003; Rusu et al., 2011).

The obtained results are presented in Table 3.

Table 3. The effectiveness of Ivermec-OR against gallinaceous birds ectoparasites

Species of parasites	pheasants				chickens			
	Before therapy		After therapy		Before therapy		After therapy	
	EI (%)	II (ex.)	EI (%)	II (ex.)	EI (%)	II (ex.)	EI (%)	II (ex.)
Bird lice								
<i>Cuclotogaster cinereus</i> (Nitzsch, 1866)	15.3	18.0	2.0	1.0				
<i>Cuclotogaster heterographus</i> (Nitzsch, 1866)	71.9	83.0	-	-				
<i>Goniocotes chrysocephalus</i> (Giebel, 1874)	56.9	78.5	-	-				
<i>Goniocotes microthorax</i> (Stephens, 1829)	32.3	65.4	-	-				
<i>Goniodes colchici</i> (Denny, 1842)	41.7	96.0	-	-				
<i>Goniodes dissimilis</i> (Denny, 1842)	11.8	9.0	-	-	5.9	7.0	-	-
<i>Lipeurus caponis</i> (Linné., 1758)	21.2	43.0	-	-	2.7	3.0	-	-
<i>Menacanthus stramineus</i> (Nitzsch, 1818)	74.1	99.0	-	-	14.1	12.0	-	-
<i>Menopon gallinae</i> (Linnaeus, 1758)	32.5	64.0	-	-	45.1	78.0	-	-

<i>Eomenacanthus stramineus</i> _(Nitzsch, 1818)					79.5	84.2	2.7	2.0
<i>Goniocotes gallinae</i> _(de Geer, 1778)					31.2	17.9	-	-
<i>Goniocotes maculatus</i> (Taschenberg, 1882)					12.3	11.0	-	-
<i>Menacanthus cornutus</i> _(Schommer, 1913)					2.9	9.0	-	-
<i>Menacanthus pallidulus</i> (Neumann, 1912)					7.6	5.8	-	-
Fleas								
<i>Ceratophylus gallinae</i> (Schrank, 1803)	14.3	27.0	1.0	1.0	19.4	16.9	-	-
<i>Ceratophylus hirundinis</i> (Curtis, 1826)	23.8	42.1	-	-	12.5	9.7	-	-
Gamasid mites								
<i>Dermanyssus gallinae</i> (Degeer, 1778)	56.9	76.2	2.4	1.0	67.3	81.2	1.9	1.0
<i>Dermanyssus hirundinis</i> (Dugès, 1834)	17.2	32.6	-	-	21.1	26.5	-	-

As a result of the research, there was established that Ivermec-OR has a high antiparasitic action of about 100%, against ectoparasites in the tested gallinaceous birds. At the same time, it is not allowed to administer the product to laying hens and chickens at least 14 days before the eggs are placed in the incubators due to the accumulation of Ivermectin in the eggs. The slaughter is allowed not earlier than 9 days after the last administration of the Ivermec-OR.

CONCLUSIONS

It was found that the natural extract Ectogalimol – a biologically active remedy obtained from the plant raw material, dry aerial parts of Dalmatian chamomile (*Pyretrum cinerariifolium* Trev.) in a concentration of 3%, administered by spraying gallinaceous birds, in two rounds, at an interval of 14 days, in a dose of 50 ml per bird, has a high therapeutic efficacy - approx. 100% against the various species of ectoparasites (bird lice, fleas and gamasid mites).

The drug Ectogalimol 3% is not toxic and therefore the overdose does not produce adverse reactions, it does not require high costs and a large volume of work, and after the administration there are no restrictions on the consumption of products and by-products of the treated birds.

The drug Ivermec-OR has an antiparasitic action of approx. 100% against various species of bird lice, fleas and gamasid mites in gallinaceous birds.

The administration of the Ivermec-OR is forbidden to laying hens at least 14 days before the eggs are laid for incubation due to the accumulation of ivermectin in the eggs.

The slaughter of birds treated with Ivermec-OR is allowed not earlier than 9 days after the last administration. In the case of the forced slaughter of birds before the expiration of the mentioned period, it is allowed to use the meat as food for the fur animals or to transform it into meat and bone meal after heat treatment.

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