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COLLECTION, PROPHYLAXIS, AND BIOLOGICAL TREATMENT PROCEDURE FOR ECTOPARASITES IN PHEASANTS

Ștefan RUSU, Dumitru ERHAN, Maria ZAMORNEA, Ion TODERAȘ, Oleg CHIHAI, Viorelia RUSU, Ion GOLOGAN

Institute of Zoology, SUM, 1 Academiei Str., Chișinău, Republic of Moldova

Corresponding author email: rusus1974@yahoo.com

Abstract

The procedure refers to veterinary medicine, particularly parasitology, and can be used for the prophylaxis and treatment of ectoparasites in pheasants from various natural and anthropized biotopes. This procedure involves treating pheasants by spraying them with the Ectogalimol 5% preparation – a 5% aqueous solution of natural extract obtained by hydroalcoholic extraction from the aerial parts of Dalmatian chamomile (Pyrethrum cinerariifolium Trev.), followed by drying, at a dose of 50 ml per pheasant. For diagnostic and prophylactic purposes, the treatment is carried out in one session, while for therapeutic purposes, it is performed in two sessions with a 14-day interval. It has been found that the Ectogalimol 5% preparation possesses high therapeutic efficacy against various species of ectoparasites in pheasants from the following families: Family Philopteridae (Cuclotogaster cinereus, Cuclotogaster heterographus, Goniocotes chrysocephalus, Goniocotes microthorax, Goniodes colchici, Goniodes dissimilis, Lipeurus caponis); Family Menoponidae (Amyrsidea perdicis, Menacanthus stramineus, Menopon gallinae); Family Ceratophyllidae (Ceratophylus gallinae, Ceratophylus hirundinis); and Family Dermanyssidae (Dermanyssus gallinae, Dermanyssus hirundinis). The clinical condition of the pheasants improved after treatment, the birds became calmer, and their appetite and behavior increased.

Key words*: collection, infestation, parasitic agents, pheasants, prophylaxis, treatment.*

INTRODUCTION

The study of the infestation mechanism of animals with ecto- and endoparasites, particularly in species of hunting importance, constitutes a fundamental and, especially, practical problem, as some species serve as intermediate hosts in the developmental cycle of various parasite species and as transmitters of these parasites, which are dangerous for both humans and domestic animals. Parasitic diseases are considered the most commonly encountered illnesses in wild animals, leading to significant economic losses (Erhan, 2024; Miron, 2002; Rusu et al., 2020; Olteanu et al., 1991).

The study of the parasitic fauna in animal species from the hunting fauna, as well as the relationships between the parasite and the host, constitutes a main issue in contemporary parasitology. Research on these aspects allows for a deeper understanding of the pathogenesis of parasitic diseases, clinical manifestations, and the efficacy of antiparasitic treatments. Most specialists in parasitology and helminthology regard parasitic diseases, particularly helminthiases, as harmful and aggressive factors, from which the host organism should be freed as quickly as possible. However, another aspect of this issue is not always considered. The exclusion of one component of the system, the parasite, through treatment, may affect the other component - the host. The relationships in the parasite-host system have developed over a long period through the evolutionary process of the animal world, and thus, they must be examined as a complex self-regulating system with mutually adaptive components. The reciprocal adaptation to facultative parasitism is more simply expressed and practically absent in the case of a transit host. In the invasion process, the degree of reciprocal adaptation between the parasite and the host undergoes both quantitative and qualitative changes. Among the adaptations of obligatory parasites (definitive hosts) are high and long-lasting prolificacy, while the host's adaptation is the inability to develop absolute immunity against the parasite. Only under such conditions is it possible to study the long-term viability of parasites within the host organism, and their ability to produce large numbers of eggs and larvae ensures their evolutionary cycle

in nature. Sometimes, the frequency and abundance of infestations in game birds can be influenced by a range of factors, such as the distribution of intermediate and complementary hosts, age, sex, infestation rate, the number of infective eggs and larvae, etc. It is known that game birds are more exposed to risks in their first year of life, when their mortality rate can reach about 90%, due to the interaction between infectious diseases and parasitic diseases with helminthic specificity (Șuteu, 2017; Erhan et al., 2017; Șuteu et al., 2007; Dărăbuș, 2006; Șuteu et al., 2003; Olteanu et al., 1999; Akbaev, 1990).
In recent years, complex research and an analysis of the infestation levels of key species of hunting importance, and their role in the formation and maintenance of outbreaks of parasitic agents in natural and anthropized biotopes, as well as their significance in the infestation of domestic animals, have not been carried out in the Republic of Moldova (Erhan, 2020; Rusu, 2021; Zamornea et al., 2010).
The common pheasant (Phasianus colchicus L.) represents the most important bird for the hunting fauna in the Republic of Moldova, both in terms of its numerical share and spread, as well as its hunting prospects. Analyzing the dynamics of pheasant populations in recent years in the Republic of Moldova, a positive trend in the dynamics of acclimatization was highlighted, thanks to comprehensive protection measures and the continuous repopulation of pheasants in nature from specialized breeding facilities. The breeding stock of pheasants in the spring of 2018 was estimated at around 42,000 specimens, with an annual increase of 75-90%. Despite the aforementioned measures, the pheasant population continues to grow by only 13-18% year by year, signaling a drastic decrease in their numbers during the cold season. The various measures aimed at increasing the population of hunting animals will not be sufficient, as parasitic diseases not only hinder growth and development but also cause mortality. Ectoparasites found in pheasants (*Phasianus colchicus* L.) are considered a significant cause not only of productivity losses but also of illnesses and, often, even mortality. Frequently, both in domestic and wild birds of hunting interest, polyparasitism is recorded (Rusu, et al., 2021; Erhan, 2020; Toderaș et al., 2017).
The presence and circulation of pathogenic agents in the organisms of animals and humans significantly reduce their immunological resistance and make them more susceptible to infectious disease agents, favoring their development, with serious consequences for public health and the national economy (Erhan et al., 2007; Olteanu et al., 2001; Marquardt et al., 2000; Niculescu et al., 1998).
For the successful development of the hunting sector and the increase in animal populations, it is necessary to continuously improve the maintenance technology for these animals and use new biological methods for the prevention and control of parasitic diseases. It has been observed that in hunting farms where parasitic diseases are recorded, the mortality rate is increasing. Success in combating parasitic diseases in animals can only be ensured with the active and organized participation of all specialists in the veterinary sector. It is well known that it is easier to prevent a disease than to treat it. The prevention of parasitic diseases is largely conditioned by the coordination of the activities of specialists in the veterinary sector, adherence to technological maintenance and feeding measures, etc. Compliance with the entire set of measures is a decisive factor in increasing the number of animals. However, the economic factor is not decisive, as many parasitic diseases in wild animals are also common to humans. Therefore, specialists in the veterinary sector are also responsible for public health. According to the World Health Organization's definition, public health is: "The science and art of preventing disease, prolonging life, and promoting health through the organized efforts of society".
Economic losses caused by parasitic diseases in wild animals of hunting interest are not constant. In this context, the generalization of experimental data regarding the damage caused by parasitic diseases in hunting farms requires constant updates to make adequate decisions in the development of prevention and treatment measures (Rusu et al., 2021; Dărăbuș, 2014; Șuteu et al., 2011; Șuteu et al., 2007; Akbaev et al., 2000; Didă, 1996; Bejsovec, 1972).

MATERIALS AND METHODS

Currently, several methods are known for collecting ectoparasites from pheasants. The manual collection method of ectoparasites from small mammals and dead or hunted birds, according to Dubinina (1971), consists of collecting ectoparasites using tweezers and a scalpel. This method requires a large amount of work, is cumbersome, and does not allow for the complete collection of ectoparasites, as after the death of the host bird, most ectoparasite species leave it in search of another living host. Additionally, this procedure cannot be applied to examining rare and endangered species whose hunting is prohibited.

Another known method for the prophylaxis and treatment of ectoparasites in chickens is outlined in the short-term invention patent MD 408 Z 2012.03.31. This method involves combating ectoparasites in chickens using an extract from the aerial parts of Dalmatian chamomile (*Pyrethrum cinerariifolium* Trev.) at a 3% aqueous solution concentration (the product Ectogalimol), which is administered to the birds by spraying in a dose of 50 ml per bird in two applications, with an interval of 14 days. Prophylactic measures are carried out by spraying the birds in a single application, with a dose of 50 ml per bird (Luncașu et al., 2007).

The collection of ectoparasites from living birds, according to the method developed by Luncașu M. and Zamornea M., involves placing the live bird into a bag with dimensions of 20-25 x 30-35 cm or 30-35 x 40-55 cm and fixing 3-4 pads soaked in a lethal solution for ectoparasites under each wing. The opening of the bag is then tightened around the bird's head, ensuring that the eyes and beak remain outside. The bird is placed on a flat surface and kept for 5-10 minutes until the ectoparasites are immobilized. Afterward, the bird is removed from the bag, the ectoparasites are shaken off, and they are placed in test tubes with 70% rectified ethyl alcohol. This method allows the collection of ectoparasites from living birds but has some drawbacks. One of them is the use of ether (ethoxyethane, CH3-CH2-O-CH2-CH3) as the lethal solution for ectoparasites, which is volatile and evaporates quickly, acting as a toxic substance both for the person collecting the ectoparasites and for the bird being examined. Another disadvantage of this method is that living birds of different sizes are placed in polyethylene bags, which can be easily and quickly damaged by the bird's claws. Additionally, the ectoparasites collected from the bird's body are shaken onto a white sheet of paper or a 1.5 x 1.5 m film, which can easily be blown away by the wind under field conditions. In 2021, in collaboration with colleagues from the Parasitology and Helminthology Laboratory, an innovative biological method for collecting ectoparasites from living gallinaceous birds was developed and successfully implemented (Rusu et al., 2021). This new method preserves the integrity of the ectoparasites themselves and maintains their numerical and specific composition, allowing for an accurate determination of the degree and specificity of bird infestations with ectoparasites from different systematic groups, without causing harm to the health of either the person applying the method or the birds being diagnosed.

RESULTS AND DISCUSSIONS

Ectoparasitological investigations conducted on pheasants from various nature reserves in the Republic of Moldova have highlighted an ectoparasitic structure consisting of three specific species (*Cuclotogaster cinereus, Goniocotes chrysocephalus, Goniodes colchici*) and five common species (*Eomenacanthus stramineus, Menopon gallinae, Goniocotes gallinae, Goniodes dissimilis, Lipeurus caponis*), which are also found in domestic birds in the Republic of Moldova. Furthermore, two species of fleas (*Ceratophylus gallinae, Ceratophylus hirundinis*) common to chickens, turkeys, and two species of gamasid mites (*Dermanyssus gallinae, Dermanyssus hirundinis*) were recorded in pheasants, which are shared between both wild and domestic birds. The research has shown that pheasants examined from the "Codrii" Nature Reserve presented an infestation rate of 90.0% with mallophagans, 26.0% with fleas, and 59.0% with gamasid mites. Research on the ectoparasitic fauna of wild birds of hunting interest in the Central-Northern Zone of the Republic of Moldova revealed a wide range of ectoparasites in pheasants from the following families:

Philopteridae Family – seven species:

- *Cuclotogaster cinereus* with an infestation index (EI) of 15.3% and 18.0 individuals,
- *Cuclotogaster heterographus* with EI of 71.9% and 133.0 individuals,
- *Goniocotes chrysocephalus* with EI of 56.9% and 78.5 individuals,
- *Goniocotes microthorax* with EI of 32.3% and 65.4 individuals,
- *Goniodes colchici* with EI of 41.7% and 96.0 individuals,
- *Goniodes dissimilis* with EI of 11.8% and 9.0 individuals,
- *Lipeurus caponis* with EI of 31.2% and 43.0 individuals.

- **Menoponidae Family** – three species:
  - *Amyrsidea perdicis* with EI of 32.7% and 93.0 individuals,
  - *Menacanthus stramineus* with EI of 74.1% and 109.0 individuals,
  - *Menopon gallinae* with EI of 32.5% and 64.0 individuals.
- **Ceratophyllidae Family** – two species:
  - *Ceratophylus gallinae* with EI of 14.3% and 27.0 individuals,
  - *Ceratophylus hirundinis* with EI of 23.8% and 42.1 individuals.
- **Dermanyssidae Family** – two species:
  - *Dermanyssus gallinae* with EI of 56.9% and 76.2 individuals,
  - *Dermanyssus hirundinis* with EI of 17.2% and 32.6 individuals.

These findings underline the diversity of ectoparasitic infestations present in pheasants in the region, which can significantly impact the health of these wild birds, as well as influence their management and conservation (Table 1.).

Out of the total of 14 ectoparasite species identified in the pheasant (*Phasianus colchicus* L.), only one species – 7.1% (*Goniodes colchici*) is specific to the pheasant (*Phasianus colchicus* L.), while ten species – 71.4% (*Cuclotogaster cinereus, Goniocotes chrysocephalus, Goniodes dissimilis, Lipeurus caponis, Menacanthus stramineus, Menopon gallinae, Ceratophylus gallinae, Ceratophylus hirundinis, Dermanyssus gallinae, Dermanyssus hirundinis*) are common to the quail (*Coturnix coturnix*), nine species – 64.3% (*Cuclotogaster heterographus, Goniocotes chrysocephalus, Goniocotes microthorax, Goniodes dissimilis, Menacanthus stramineus, Menopon gallinae, Ceratophylus hirundinis, and Dermanyssus hirundinis*) are common to the partridge (*Perdix perdix*), ten species – 71.4% (*Cuclotogaster heterographus, Goniodes dissimilis, Lipeurus caponis, Amyrsidea perdicis, Menacanthus stramineus, Menopon gallinae, Ceratophylus gallinae, Ceratophylus hirundinis, Dermanyssus gallinae, Dermanyssus hirundinis*) are common to the guinea fowl (*Numida meleagris*), and eight species – 57.1% (*Cuclotogaster heterographus, Goniodes dissimilis, Lipeurus caponis, Menopon gallinae, Ceratophylus gallinae, Ceratophylus hirundinis, Dermanyssus gallinae, Dermanyssus hirundinis*) are common to domestic chickens (*Gallus gallus domesticus Linnaeus, 1758*) (Figure 1).

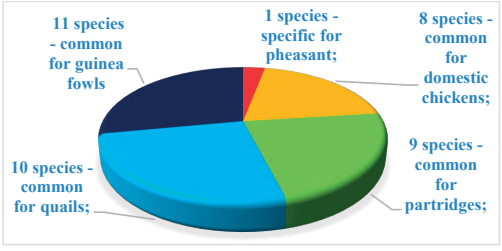

Figure 1. Specificity of ectoparasite species identified in pheasants (*Phasianus colchicus* L.)

The biological method for collecting ectoparasites from pheasants includes spraying the bird with a natural extract from the dried aerial parts of Dalmatian chamomile (*Pyrethrum cinerariifolium Trev.*), using an aqueous solution (Ectogalimol preparation) at a concentration of 5%, applying 50 ml to each bird. The bird is then placed in a nylon bag with dimensions of 20-25 x 30-35 cm or 30-35 x 40-55 cm, with the opening of the bag tightened around the bird's head, leaving the eyes and beak outside. The bird is laid horizontally on a flat surface and kept for 5-10 minutes to immobilize the ectoparasites. Afterward, the bird is removed from the bag, and the ectoparasites are shaken into a plastic container with a white inner surface, 35.0-40.0 cm in diameter and 40.0-50.0 cm in height. The collected ectoparasites are then placed in test tubes with 70% rectified ethyl alcohol.

Table 1. Diversity of ectoparasitic fauna in wild birds of hunting interest from the Central-North Zone of the Republic of Moldova

Specii de paraziţi	Parasitized host									
	Pheasant (*Phasianus colchicus* L.)		Quail (*Coturnix coturnix*)		Partridge (*Perdix perdix*)		Guinea fowl (*Numida meleagris*)		Chickens (*Gallus gallus domesticus* Linnaeus, 1758)	
	EI (%)	II (ex.)	EI (%)	II (ex.)	EI (%)	II (ex.)	EI (%)	II (ex.)	EI (%)	II (ex.)
1	2	3	4	5	6	7	8	9	10	11
CLASS INSECTA										
Family Philopteridae										
Cuclotogaster cinereus (Nitzsch, 1866)	15.3	18.0	90.0	240.0	-	-	-	-	-	-
Cuclotogaster heterographus (Nitzsch, 1866)	71.9	133.0	-	-	3.7	6.0	32.1	21.2	45.2	65.1
Cuclotogaster heterogrammicus (Nitzsch [in Giebel], 1866)	-	-	-	-	8.9	7.0	-	-	-	-
Goniocotes chrysocephalus (Giebel, 1874)	56.9	78.5	24.1	32.3	19.7	21.3	-	-	-	-
Goniocotes microthorax (Stephens, 1829)	32.3	65.4	-	-	15.9	17.4	-	-	-	-
Goniodes astrocephalus (Burmeister, 1838)	-	-	41.5	20.0	-	-	-	-	-	-
Goniodes colchici (Denny, H. 1842)	41.7	96.0	-	-	-	-	-	-	-	-
Goniodes dispar (Burmeister, 1838)	-	-	21.7	17.9	81.3	211.0	-	-	-	-
Goniocotes maculatus (Taschenberg, 1882)	-	-	-	-	-	-	1.0	3.0	21.2	34.7
Goniodes dissimilsis (Denny, 1842)	11.8	9.0	9.1	6.0	1.9	3.0	7.2	12.7	43.5	56.7
Goniocotes gallinae (De Geer, 1778)	-	-	22.7	54.1	-	-	35.9	48.0	31.8	65.2
Lipeurus caponis (Linné. 1758)	31.2	43,0	48.0	34.0	-	-	1.0	6.0	11.8	26.7
Family Menoponidae										
Amyrsidea perdicis (Denny, 1842)	32.7	93.0	-	-	31.9	41.0	25.0	27.0	-	-
Menacanthus abdominalis (Piaget, 1880)	-	-	41.6	8.0	-	-	-	-	-	-
Menacanthus stramineus (Nitzsch, 1818)	74.1	109.0	44.3	56.0	81.3	231.0	32.4	23.9	-	-
Menopon gallinae (Linnaeus, 1758)	32.5	64.0	63.0	186.0	33.7	18.6	45.8	57.9	89.4	235.9
Eomenacanthus stramineus (Nitzsch, 1818)	-	-	-	-	-	-	-	-	83.2	345.1
Menacanthus cornutus (Schomer, 1913)	-	-	-	-	-	-	-	-	19.8	27.1
Menacanthus pallidulus (Neumann, 1912)	-	-	-	-	-	-	-	-	17.4	21.6
Fleas										
Family Ceratophyllidae										
Ceratophylus gallinae (Schrank, 1803)	14.3	27.0	45.7	56.0	-	-	37.9	56.2	67.3	77.4
Ceratophylus hirundinis (Curtis, 1826)	23.8	42.1	39.1	48.0	21.7	34.9	27.3	41.0	45.8	54.2
Parasitiform mites										
Family Dermanyssidae										
Dermanyssus gallinae (De Geer, 1778)	56.9	76.2	57.3	68.7	-	-	32.5	44.1	89.2	135.2
Dermanyssus hirundinis (Dugès, 1834)	17.2	32.6	45.1	54.3	43,9	77.1	33.9	17.8	65.4	87.3

Thus, the recommended method is not dangerous for either the person conducting the investigation or the pheasant under investigation, as the solution used to kill the ectoparasites is the Ectogalimol 5% solution, which is a biologically active natural extract obtained from plant raw materials and has high therapeutic efficacy against various species of ectoparasites identified in pheasants (louse species such as *Cuclotogaster heterographus*, *Eomenacanthus stramineus*, *Goniocotes gallinae*, *Goniocotes maculatus*, *Goniodes dissimilis*, *Lipeurus caponis*, *Menopon gallinae*, *Menacanthus cornutus*, *Menacanthus pallidulus*; fleas such as *Ceratophylus gallinae*, *C. hirundinis*; and gamasid mites such as *Dermanyssus gallinae*, *D. hirundinis*). Experiments determining the therapeutic

efficacy of the Ectogalimol preparation against ectoparasites in poultry were conducted between 2016 and 2019 in various natural and anthropized biotopes. The plant-derived Ectogalimol preparation is synthesized by the collaborators of the Parasitology and Helminthology Laboratory of the Institute of Zoology, in collaboration with the Advanced Biological Technologies Center of the Institute of Genetics, Physiology, and Plant Protection (Invention Patent no. 408 of March 31, 2012).

The preparation is obtained by the following process: 500 g of dried aerial parts of Dalmatian chamomile (*Pyrethrum cinerariifolium* Trev.) are extracted with a 60% alcoholic-water solution in a 1:4 ratio using a water bath with a refrigerant for 8 hours. This procedure is repeated three times, and the extracts, after filtration, are combined and distilled to dryness in a vacuum evaporator at 50°C. 38.7g of biologically active dry substance is obtained. The control is performed using thin-layer chromatography on "Silufol" plates with a solvent system of "chloroform: methanol" = 75:25 (v/v). For the research, aqueous solutions of concentrations 3.0%, 4.0%, 5.0%, and 6.0% were used. For example, a 7.0% solution = 7 g of dry substance dissolved in 93 ml of non-chlorinated water.

The method proceeds as follows: initially, both domestic (chickens, turkeys) and wild (pheasants, quails) poultry are investigated for the presence of ectoparasites. The study of ectoparasite diversity in domestic and wild poultry from various natural and anthropized biotopes in the Republic of Moldova revealed a rich range of ectoparasites from the following families: Family Philopteridae (*Cuclotogaster cinereus, Cuclotogaster heterographus, Goniocotes chrysocephalus, Goniocotes microthorax, Goniodes colchici, Goniodes dissimilis, Lipeurus caponis*); Family Menoponidae (*Amyrsidea perdicis, Menacanthus stramineus, Menopon gallinae*); Family Ceratophyllidae (*Ceratophylus gallinae, Ceratophylus hirundinis*); and Family Dermanyssidae (*Dermanyssus gallinae, Dermanyssus hirundinis*). After determining the ectoparasite fauna, experimental groups are formed. From each bird species with a high level of ectoparasite infestation, groups of 10 birds are formed for each lot.

After forming the experimental groups, the Ectogalimol solution is prepared in various concentrations. Aqueous solutions of 3.0%, 4.0%, 5.0%, and 6.0% concentrations are used for research. Pheasants are sprayed with the natural extract of Dalmatian chamomile (*Pyrethrum cinerariifolium* Trev.) in the concentrations mentioned above, applying 50 ml to each bird. After spraying, the bird is placed in a nylon bag that is appropriately sized for it, with the opening tightened around the head, leaving the eyes and beak outside. The bird is placed horizontally on a flat surface, such as a table, and kept in this position for 5-10 minutes at an ambient temperature of 20-30°C. This time is sufficient to immobilize the ectoparasites. The bird is then removed from the bag, and the ectoparasites are shaken off into a prepared container, a white plastic vessel 35.0-40.0 cm in diameter and 40.0-50.0 cm in height. The nylon bag is made of a group of textile fibers from synthetic polymers, known as polyamides – the first synthetic polymer that achieved commercial success due to its low cost, light weight, and durability. The dimensions of the nylon bag depend on the size of the bird. For small birds like chickens, pheasants, and quails: 20-25 x 30-35 cm; for larger birds like roosters and turkeys: 30-35 x 40-55 cm.

The study of the efficacy of the Ectogalimol preparation at different times and concentrations on pheasants allowed us to select and recommend the 5.0% Ectogalimol solution for collecting ectoparasites from live pheasants, as it allows for the immobilization of ectoparasites in 100% of cases within 5-10 minutes. Ectoparasites collected from each pheasant are placed in separate test tubes containing 70% rectified ethyl alcohol, with each test tube labeled. The label includes the bird species, the date of the investigation, the name of the farm or locality, and the name of the specialist who collected the ectoparasites. For field research, wild gallinaceous birds are first captured using fine mesh nets. The nylon bags are selected according to the size of the captured birds. Ectoparasite collection from gallinaceous birds is carried out in glass test tubes containing 70% rectified ethyl alcohol.

CONCLUSIONS

Therefore, the biological method for collecting ectoparasites from live pheasants involves spraying them with a natural extract from the dried aerial parts of Dalmatian chamomile (*Pyrethrum cinerariifolium* Trev.) using an aqueous solution (Ectogalimol preparation) at a 5.0% concentration, applying 50 ml to each bird. The bird is then placed in a nylon bag with dimensions of 20-25 x 30-35 cm or 30-35 x 40-55 cm. The opening of the bag is tightened around the bird's head, leaving the eyes and beak outside. The bird is laid horizontally on a flat surface and kept for 5-10 minutes until the ectoparasites are immobilized. Afterward, the bird is removed from the bag, and the ectoparasites are shaken into a white plastic container with a diameter of 35.0- 40.0 cm and a height of 40.0-50.0 cm. The collected ectoparasites are then placed in test tubes containing 70% rectified ethyl alcohol.
Therefore, this biological method of collecting ectoparasites from live pheasants is harmless both to the person performing the investigation and to the pheasant being investigated, as the ectoparasiticidal solution used is the 5% Ectogalimol solution, which is a biologically active natural extract obtained from plant raw materials. This solution has high therapeutic efficacy against various species of ectoparasites identified in pheasants.

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