SOME PARTICULARITIES REGARDING THE INFESTATION AND DEPARASITIZATION OF THE ROE DEER (*CAPREOLUS CAPREOLUS* LINNAEUS, 1758), DEPENDING ON THE TYPE OF STRESS REACTIVITY

UNELE PARTICULARITĂȚI CU REFERIRE LA INFESTAREA ȘI DEPARAZITAREA SPECIEI DE CĂPRIOR (*CAPREOLUS CAPREOLUS* LINNAEUS, 1758), ÎN DEPENDENȚĂ DE TIPUL DE STRES-REACTIVITATE

CZU: 599.735.311:576.89 **https://doi.org/10.59295/spd2024n.44**

Ștefan RUSU,
ORCID: 0000-0002-3204-5436
e-mail:rusus1974@yahoo.com
Institute of Zoology, Moldova State University
Dumitru ERHAN,
ORCID: 0000-0001-9722-4382
e-mail:dumitruerhan@yahoo.com
Institute of Zoology, Moldova State University
Maria ZAMORNEA,
ORCID: 0000-0001-8987-3390
e-mail: mariazamornea@gmail.com
Institute of Zoology, Moldova State University
Ion TODERAŞ,
ORCID: 0000-0001-6159-5325
e-mail: iontoderaș@yahoo.com
Institute of Zoology, Moldova State University
Viorelia RUSU,
ORCID: 0009-0006-2400-7030
e-mail: viorelia1@yahoo.com
Institute of Zoology, Moldova State University
Ion GOLOGAN,
ORCID: 0000-0002-8463-2093
e-mail: gologanionel@gmail.com
Institute of Zoology, Moldova State University

Rezumat. *Adaptarea animalelor la condiţiile actuale depinde, în primul rând, de specificitatea individuală a activităţii sistemului nervos superior. Astfel, prin aplicarea probei adrenalinice formulate de Ahmadiev G. [1, p.85] și modificată de autorii Rusu Ș. și colab. [2]. În premieră a fost elaborat, brevetat și implementat în practică un nou procedeu de apreciere a sensibilităţii cervidelor la factorii de stres, care are drept scop formarea șeptelurilor de animale*

cu o rezistență majoră la infestarea cu agenți parazitari și cu o înaltă eficacitate terapeutică antiparazitară. Se recomandă selectarea cervidelor după tipul de stres-reactivitate și a obține efective de animale stres-rezistente, care posedă o înaltă rezistență la infestarea cu paraziți cu o înaltă eficacitate terapeutică și cu minim cheltuieli la deparazitare. Prin urmare, este necesar ca, înainte de aplicarea tratamentului la cervide, de stabilit tipul lor de stres-reactivitate, iar la cele stres-reactive de aplicat tratament repetat peste 14 zile, deoarece eficacitatea tratamentului este variată și depinde de tipul de reactivitate al organismului animal.

Keywords: *deer, parasitic species, stress reactivity.*

INTRODUCTION

Stress presents a complex of non-specific reactive changes of neuro-endocrino-metabolic order, caused by the action of various external or internal environmental factors, through which the organism tends to resist and adapt to new conditions of existence [3-7].

The first researchers who reported the stress-inducing action of parasitic metabolites were H. Selye [3], then O. Maslov, L. Bezenco, F. Meerson [8-9] etc.

During the parasitic invasion, the host is deprived of lipids, glucides, and protides, as well as a number of biologically active compounds (vitamins and enzymes), monoaminobiogens, and biologically active lipids [10].

It is known that parasitic infestations decrease the quantity and quality of animal production. The primary effect is often a subclinical manifestation, represented by a reduction in appetite, reproduction, and lactation. Most parasitological studies have focused on domestic animals, but it has recently been established that parasitic infestations are equally common and important in wild animals, which can serve as potential reservoirs of parasites. Therefore, wild animals significantly contribute to the preservation of natural parasite foci common to domestic animals and humans. In this context, the study of the parasitic fauna of cervids is particularly important [11-13].

The issue of antiparasitic protection for humans and animals, based on the concept of integrated prophylaxis, includes a set of theoretical principles, practical means and methods, and organizational measures to combat parasites in host organisms, as well as protecting the environment from parasitic invasion. The prophylactic act involves complex, differentiated measures depending on the specific conditions and lifestyle of the hosts, aiming to maintain parasite-free communities, detect diseases through efficient diagnostic means, and assess the structure and evolution of the parasitic process. A scientific perspective on the effectiveness of prophylactic measures also includes the economic dimension, reflecting the limits of human, financial, and general efforts regarding the profitability of measures in animal populations.

The prevention of environmental contamination, with host animals as the source of pollution, requires the development of complex measures that are sometimes difficult to implement due to the varied systems of maintenance and exploitation of these animals [14].

The adaptation of animals to current conditions depends primarily on the individual specificity of the activity of the higher nervous system. The reactivity and adaptability

of the animal organism to stress factors are decisively influenced by the level of stress resistance, which essentially involves the type of higher nervous activity [15, 16].

In numerous parasitoses, or only in certain evolutionary phases of parasites, the reactive phenomena of host organisms are multiple and complex, integrated into the defensive system. In some situations, the limits and intensity of cellular or tissue mechanisms cannot be precisely defined, as they are equally involved in countering both the agents and the harmful parasitic products [17].

As seen in working with animals, it is very important to understand their sensitivity to parasitic factors. The terms "sensitive" and "resistant" are commonly used by many authors but so far lack precise definitions. "Sensitivity" implies the state of the organism when, in the host-parasite relationship, the host can maintain an environment conducive to the parasite's survival, development, and maturation. "Resistance" refers to the state when the host possesses both innate and conditioned qualities that limit the parasite's development to a certain stage within the host. [18, 19].

According to other authors, stress reactivity is understood as the level of animal reactions to the action of stress factors, while stress resistance refers to the animal's ability to adapt to new conditions without a noticeable loss of productivity. By understanding the organism's adaptation capabilities, the mechanisms of these reactions, and their activation methods, it is possible to increase the efficiency of animal husbandry. A significant practical interest lies in determining stress reactivity and stress resistance in cattle. It has been determined that the manifestation of stress depends not only on the type and nature of the stress factor but also on the breed, age, and sex of the animals [20, 21].

Literature analysis demonstrates that the sensitivity of animals to parasitic stress factors is largely associated with the increase or decrease in corticosteroid capabilities. Attempts have been made to determine stress reactivity in cattle based on constitution type, reproductive qualities, milk elimination time, and somatic cell count in milk. Some authors have used ACTH to determine leukocyte, neutrophil, eosinophil, lymphocyte counts, and glucose levels. The variation in these indices to some extent reflects the organism's adaptation response and the functional state of the hypothalamic-pituitary-adrenal system. For determining stress sensitivity and reactivity in cattle, recommended indices include blood corticosteroid levels, adrenal gland ascorbic acid content, cholesterol, free fatty acids, creatine phosphokinase, lactate dehydrogenase, lactate, glucose etc. [22, 23, 24].

The methodology for testing stress reactivity in cattle based on blood corticosteroid levels has been studied, with parallel determination of the animals' aggressiveness coefficient. According to other sources, for this purpose, the lysozyme-cationic test can be applied. [25, 26].

MATERIAL AND METHOD

The biological samples collected during the experiments were examined using coproovoscopic methods (*Fulleborn*, *Darling*) and coprolarvoscopic methods (*Popov*, *Baermann*), partial parasitological investigations (according to *K.I. Skriabin*), and suc-

cessive washings. The intensity of the invasion by nematodes, fasciola eggs, dicrocoelium, and eimeria oocysts was determined in 5g of feces in 10 visual microscopic fields (10x40). The systematic determination of parasite species was conducted according to Fauna Europaea. Parasitological evaluation is based on determining the extensiveness of invasion (EI%) and intensity of invasion (specimens/animal) in the investigated animals. Coprological investigations were performed on no less than 10-20% of the entire herd, but no more than 30-50% (300 samples) of each group. Since the elimination of parasitic elements from the organism is uneven throughout the day, it is necessary to collect samples from multiple fecal emissions (preferably within 24 hours) and mix them.

The determination of the type of stress reactivity in cervids (roe deer - *Capreolus capreolus* Linnaeus, 1758) was carried out using the adrenaline method formulated by Ahmadiev G. and modified by Rusu Ș. and collab. [2].

The adrenaline method consists of the action of a 0.1% adrenaline hydrochloride solution on the immunological reactivity of animals. The research focuses on the blood system, which responds quickly to factors of varying intensity. Additionally, it plays a decisive role in both non-specific and specific protective reactions of the organism, influencing its resistance and reactivity. For this purpose, the 0.1% adrenaline hydrochloride solution is brought to an isotonic concentration with sodium chloride.

To achieve the proposed goal, research was conducted on blood sample collection and the selection of roe deer (*Capreolus capreolus* Linnaeus, 1758) based on the type of stress reactivity by applying the adrenaline test formulated by Ahmadiev G. in 1990, with some new modifications introduced. The cervids were then divided into two groups: Group I - stress-reactive cervids, and Group II - stress-resistant cervids. The experiments were conducted in various natural and anthropized biotopes, zoos, and game farms specialized in raising cervids.

For the purpose of sample collection, measures for sedation and immobilization of roe deer (*Capreolus capreolus* Linnaeus, 1758) were undertaken. A pneumatic gun (*Dan-inject MOD 1 M*) was used for this purpose, with syringes containing a 1% injectable solution of *Ditilin*.

Thus, these extremely important adjustments to the adrenaline test formulated by Ahmadiev G. [1, p.85] and modified by Rusu Ș. and collab. [2], allowed us, for the first time, to select cervids based on their type of stress reactivity.

The simplicity of the method, the minimal cost of the preparations and equipment, allows for its widespread application, which is of major importance in determining the reactivity of the organism in roe deer (Capreolus capreolus Linnaeus, 1758).

RESULTS AND DISCUSIONS

Additionally, research was conducted to identify the level of infestation and determine the effectiveness of antiparasitic treatment in roe deer (Capreolus capreolus Linnaeus, 1758) with different types of stress reactivity. For this purpose, following the adrenaline test formulated by Ahmadiev G. [1, p.85] and modified by Rusu Ș. and collab. [2], 26

roe deer (*Capreolus capreolus* Linnaeus, 1758) were tested and divided into two groups: Group I - stress-reactive, and Group II - stress-resistant, with 10 cervids in each group.

The cervids from both groups were subjected to parasitological investigations. In Group I (stress-reactive) the following indices of extensiveness of invasion (*EI*) and intensity of invasion (*II*) were established: *Fasciola hepatica* - *EI* - 40% of cases, *II* - 1.7 specimens, *Dicrocoelium lanceolatum* - *EI* - 50.0%, *II* - 2.8 specimens, *Strongyloides papillosus* - *EI* - 100.0% and *II* - 22.0 specimens, *Cooperia punctata* - *EI* - 60.0% and *II* - 12.0 specimens, *Ostertagia ostertagi* - *EI* - 40.0% and *II* - 6.2 specimens, *Toxocara vitulorum* - *EI* - 20.0% and *II* - 3.5 specimens, *Eimeria ponderosa* - *EI* - 60.0% and *II* - 5.0 specimens, *E. capreoli* - *EI* - 80.0% and *II* - 6.9 specimens, and *E. bovis* - *EI* - 30.0% and *II* - 4.3 specimens (tab. 1).

In Group II (stress-resistant) the following level of infestation was established: *Fasciola hepatica* - *EI* - 20.0%, *II* - 1.0 specimens, *Dicrocoelium lanceolatum* - *EI* - 30.0%, II - 2.0 specimens, *Strongyloides papillosus* - *EI* - 70.0% and *II* - 8.4 specimens, *Cooperia punctata* - *EI* - 40.0% and *II* - 5.2 specimens, *Ostertagia ostertagi* - *EI* - 30.0% and *II* - 5.3 specimens, *Eimeria ponderosa* - *EI* - 40.3% and *II* - 2.2 specimens, *E. capreoli* - *EI* - 60.0% and *II* - 2.3 specimens, and *E. bovis* - *EI* - 20.0% and *II* - 3.5 specimens (tab. 1).

Table 1. Level of infestation in roe deer (*Capreolus capreolus Linnaeus*, 1758), with varying types of stress reactivity, before and after antiparasitic treatment

Parasite species	Before treatment				After treatment			
	Group 1		Group 2		Group 1		Group 2	
	EI, %	II, ex.,	EI, %	II, ex.,	EI, %	II, ex.,	EI, %	II, ex.,
Fasciola hepatica (Linnaeus, 1758)	40.0	1.7	20.0	1.0	-	-	-	-
Dicrocoelium lanceolatum (Stiles et Hassal, 1896)	50.0	2.8	30.0	2.0	20.0	1.0	-	-
Strongyloides papillosus (Wedl, 1856)	100.0	22.0	70.0	8.4	30.0	3.0	-	-
Cooperia punctata (Linstow, 1906; Ransom, 1907)	60.0	12.0	40.0	5.2	20.0	4.5	-	-
Ostertagia ostertagi (Stiles, 1892; Ransom, 1907)	40.0	6.2	30.0	5.3	10.0	1.0	-	-
Toxocara vitulorum (Goeze, 1782)	20.0	3.5	-	-	-	-	-	-
Eimeria ponderosa (**Wetzel, 1942**)	60.0	5.0	40.0	2.2	20.0	1.0	-	-
Eimeria capreoli (**Galli-Valerio, 1927**)	80.0	6.9	60.0	2.3	30.0	1.6	-	-
Eimeria bovis (Züblin, 1908)	30.0	4.3	20.0	3.5	-	-	-	-

Based on the parasitological investigations obtained from both groups of cervids, it can be noted that the level of infestation with all identified parasite species in cervids is significantly higher in the stress-reactive group compared to those in the stress-resistant group.

After determining the type of stress reactivity and the level of infestation in both groups of cervids, a comprehensive antiparasitic treatment in the form of pellets (patented invention) was applied [2]. The pellets contain a mixture composed of corn meal, oat meal, wheat meal, sunflower seed cake, soybean meal, bentonite, iodized kitchen salt, vitamin and mineral premix for ruminants, *Diclazuril* 1%, *Levamisole* 8%, molasses, dextrin, and water, in the following component ratio per head: corn gluten feed - 133.33 g; oat feed - 133.33 g; wheat feed - 111.11 g; sunflower seed meal - 44.44 g; soybean meal - 22.22 g; bentonite - 177.77 g; iodized kitchen salt - 8.88 g; vitamin and mineral premix for ruminants - 20.0 g; *Diclazuril* 1% - 28 ml; *Levamisole* 8% - 7.0 g; molasses - 22.22 ml; dextrin - 22.22 g; water - 60.88 ml. Additionally, the mixture is administered in the form of pellets weighing 800 g each, at a dosage of one pellet per animal once.

The premix included in the pellet is a product based on vitamins, trace elements, concentrated assimilable minerals, suitable for ruminants: large cattle, cervids.

To limit the immunosuppressive effects of antiparasitic preparations on the animal's body, it is recommended to deworm cervids as follows: medicinal pellets containing 8% *Levamisole* and 1% *Diclazuril* should be administered only to groups of cervids that are not infested with trematodes. For those diagnosed with parasitic forms from the Trematoda class (such as *Fasciola hepatica*, *Dicrocoelium lanceolatum*), the recommended treatment is *Brovalzen* (powder), which has antiparasitic action against trematodes. *Brovalzen* contains 75 mg of *Albendazole* per 1 gram of powder.

Parasitological investigations conducted on cervids from Group I (stress-reactive) on the 14th day after antiparasitic treatment revealed the following results: *Dicrocoelium lanceolatum* - *EI* - 20.0% and *II* - 1.0 specimen, *Strongyloides papillosus* - *EI* - 30.0% and II - 3.0 specimens, *Cooperia punctata* - *EI* - 20.0% and *II* - 4.5 specimens, *Ostertagia ostertagi* - *EI* - 10.0% and *II* - 1.0 specimen, *Eimeria ponderosa* - *EI* - 20.0% and *II* - 1.0 specimen, and *E. capreoli* - *EI* - 30.0% and *II* - 1.6 specimens. In cervids from Group II (stress-resistant), after applying antiparasitic treatment, no parasitic agents were identified in any animal (tab. 1).

CONCLUSIONS

1. The result of the conducted study shows that the proposed method allows for selecting cervids resistant to infestation with various parasitic agents and achieves higher efficacy of antiparasitic treatment in stress-resistant cervids compared to stress-reactive ones.
2. The result of parasitological investigations after applying antiparasitic treatment to both groups of cervids allows us to note that the efficacy of the antiparasitic treatment is higher in the stress-resistant group compared to the stress-reactive group. After parasitological diagnosis 14 days after the initial treatment, antipara-

sitic treatment was repeated in the stress-reactive group. Following this treatment, parasitological investigations were conducted, which determined that cervids in both groups (stress-reactive and stress-resistant) were completely dewormed.

3. We recommend selecting cervids based on their stress-reactivity type to obtain populations of stress-resistant animals that exhibit high resistance to parasite infestation with high therapeutic efficacy and minimal deworming costs. Therefore, it is necessary to determine their stress-reactivity type before applying treatment to cervids, and for those identified as stress-reactive, repeat treatment after 14 days. This approach is essential because treatment efficacy varies depending on the animal's reactivity type.

REFERENCES

1. АХМАДИЕВ, Г.М. Адреналиновая проба для оценки индивидуальной чувствительности животных к стресс-факторам // Вестн. с. х. науки Казахстана, 1990.-№12.-С.86-87.
2. RUSU, Ş. et. al. Procedeu de apreciere a cervidelor la factorii de stres. Brevet de invenţie. MD 1667 Y 2023.01.31.
3. СЕЛЬЕ, Г. Стресс без дистресса. Москва: Прогресс, 1979. 123 с. 647.
4. ФУРДУЙ, Ф. и др. Стресс, адаптация, функциональные нарушения и санокреатология. Кишинэу: Картя Молдовей, 1999, с. 22-35.
5. ФУРДУЙ, Ф., ФЕДОРЯКА, В., ХАЙДАРЛИУ, С. Стратегия создания адаптивной системы промышленного животноводства. Кишинев: Штиинца, 1987. 187 с.
6. ФУРДУЙ, Ф., ХАЙДАРЛИУ, С., ШТИРБУ, Е. Стресс и животноводство. Кишинэу: Штиинца, 1982, с. 31-32.
7. ФУРДУЙ, Ф., ШТИРБУ, Е., СТРУТИНСКИЙ, Ф. Стресс и адаптация сельскохозяйственных животных в условиях индустриальных технологий. Кишинэу: Штиница, 1992. 223 с.
8. МАСЛОВ, О., БЕЗЕНКО, Л. Отбор первотелок по стрессоустой чивости. In: Молоч. и мясн. Скотовод. М., 1991, № 1, с. 36-37.
9. МЕЕРСОН, Ф. Адаптация, стресс и профилактика. М., 1981, с. 7-12.
10. МЕЛЬНИК, Б., РОБУ, А., ПАЛАДИЙ, Е., КАХАНА, М. Стресс и адаптация. Кишинев: Штиинца, 1978, с. 34-35.
11. RUSU, Ş. Parazitofauna, impactul parazitozelor asupra speciilor principale de importanţă cinegetică, profilaxia şi tratamentul. – Chişinău: S.n., 2021 (Lexon-Prim SRL). - 492 p.: ISBN 978-9975-163-04-0.
12. RUSU, Ș. ș. a. Particularitățile bioecologice și răspândirea insectelor hematofage invazive din familia Hippoboscidae (Diptera) la animale din Republica Moldova // Buletinul Academiei de Științe a Moldovei. Științele vieții. 2021, № 1 (341). P. 79-86. ISBN 978-9975-157-82-7.
13. RUSU, Ş., ERHAN, D. Fauna parazitară a mamiferelor sălbatice din Rezer-

vaţia Naturală „Pădurea Domnească” din Republica Moldova //Materialele Simpozionului Științific Internațional ”45 ani de învățământ superior medical veterinar din Republica Moldova”, 24-26 octombrie 2019, Chișinău, 2019, p. 500-506. ISBN 978-9975-64-310-8.ERHAN, D. Tratat de parazitoze asociate ale animalelor domestice. Chișinău, Tipografia centrală. 2020. - 1040 p. ISBN 978-9975-157-13-1.

14. ERHAN, D. Tratat de parazitoze asociate ale animalelor domestice. Chișinău, Tipografia centrală. 2020. - 1040 p. ISBN 978-9975-157-13-1.
15. PAVALIUC, P. et al. The impact of some stressors on the functional status, resistance and adaptive capacities of the calves organism during their postnatal early ontogenesis. 51st Annual meeting of Veterinary Medicine „Towards a Global Health”. 7-8 June 2012. Iaşi. P. 21.
16. OLTEANU, G. ș. a. Poliparazitismul la om, animale, plante și mediu. București: Ceres, 2001. 818 p. ISBN 973-400-4859.
17. OLTEANU, G., CURCĂ, D. Stresul şi parazitozele la animale. In: Revista Română de parazitologie. 1993, vol. III, nr. 2, pp. 31-32. ISSN 1221-1796.
18. СКОРЦОВА, Р.Г. и. др. Способ определения стрессового состояния животного // Биология. -1987.- №30.-С.12.
19. САФИУЛЛИН, Р.Т. Комплексный подход к борьбе с паразитарными болезнями жвачных животных. In: Ж. Ветеринария. 2005, № 8, с. 8-11. ISSN 0042-4846.
20. КАРПИЧ, А.Г. Стрессоустойчивость животных различного происхождения // ВНИИ Развитие и генетика с/х.. -1987.-№97.-С.38-39.
21. ПЛЯЩЕНКО, С.И., СИДОРОВ В.Т. Предупреждение стрессов у сельскохозяйственных животных. -Минск: Ураджай, 1983.-С.32.
22. ПЛЯЩЕНКО, С.И., СИДОРОВ, В.Т. Стрессы у сельскохозяйственных животных.- М.: Агропромиздат, 1987.-192с.
23. ПЛЯЩЕНКО, С.И. Стрессы - благо или зло? -Минск: Ураджай, 1991.-173с.
24. ПЕТРЯНКИН, Ф.П., ИВАНОВ, Г.И. Некоторые биохимические показатели крови у телят при введении в рацион минерально-витаминного премикса // Тез. Докл. научно.производственных конференц. по актуальн. вопр. ветеринар., 1983.- Горький.-С.51-52.
25. МАКАРЕВИЧ, Н.А. Лизосомально-катионный тест для оценки уровня резистентности организма крупного рогатого скота // Ж.Ветеринария. –1988. №5,.-С.26-28.
26. ПЛЯЩЕНКО, С.И., СИДОРОВ, В.Т. Стрессы у сельскохозяйственных животных..- М.: Агропромиздат, 1987.-192с.
27. ERHAN, D. et al. Potenţialul adaptiv şi productiv al bovinelor la acţiunea factorilor stresogeni. Moldova. –Chişinău. „Tipogr. Ştiinţa”, 2007. - 224 p. ISBN 978-9975-62-068-0.
28. СКРЯБИН, К.И. Метод полных гельминтологических вскрытий позвоночных, включая человека. Москва: Изд-во 1-го МГУ, 1928. 45 с.