

SOME PARTICULARITIES REGARDING THE IDENTIFICATION OF SPECIFIC AND COMMON PARASITE SPECIES IN DOMESTIC AND WILD ANIMALS IN THE REPUBLIC OF MOLDOVA

ȘTEFAN RUSU*, DUMITRU ERHAN*, MARIA ZAMORNEA*, OLEG CHIHAI*, ION TODERAȘ*, VIORELIA RUSU*, ION GOLOGAN*, NICOLAE NAFORNIȚA**

ABSTRACT

The study of the diversity of parasitic fauna in wild and domestic animals from various natural and anthropogenic biotopes in the Republic of Moldova revealed that 80.8% of these animals were infested with mixed forms of parasites, forming associations of two to five parasitic agents. The results suggest that the parasitic fauna of wild animals (deer, roe deer, bison) largely corresponds to that of domestic animals (cattle, sheep). Parasitological data analysis indicates that parasitic agents can be divided into two groups: those obligatory for wild animals and those common to both wild and domestic animals. The high level of infestation in wild ruminants with *Fasciola*, *Dicrocoelium*, intestinal and pulmonary strongyles, protozoa, as well as the presence of intermediate and complementary hosts, further demonstrates that these parasitic diseases play a role in maintaining the epizootic chain of diseases and significantly impact the infestation of domestic animals. Thus, the environment plays a critical role in sustaining the epizootic chain of parasitic infections. Recent parasitological studies conducted on domestic and wild animals in Moldova reveal that wild and domestic animals mutually infest each other with various parasitic agents while grazing on shared pastures.

Key words: diversity, parasitofauna, wild animals, domestic animals, infections

Introduction

The study of the infestation process in animals with ecto- and endoparasites, especially in wild animals, is an important issue, both fundamental and applied. This is particularly relevant considering that certain species of parasites use wild animals as intermediate hosts in their development cycle and can transmit these parasites to them, which has a negative impact not only on wild animals but also on domestic animals and even humans. Parasitic diseases are the most frequently encountered ailments in wild animals, leading to significant economic losses. Bibliographic data show that wild animals serve as reservoirs of parasitic agents for domestic animals [1, 2, 3, 4].

The changes that have occurred in the livestock sector over the last two decades, due to land privatization, the reorganization of livestock units, the formation of multiple small farms, and the relocation of a large number of animals from complexes to private households, have led to significant changes in the parasitic fauna. Cattle, which were previously kept in stalls, have started grazing in various anthropogenic stations and have entered natural reserves, where they can transmit pathogens to wild animals. Wild mammals play an essential role in maintaining natural parasite foci, common to both domestic animals and humans. In

most cases, the parasitic diseases affecting wild animals are also common to domestic animals. The relocation and grazing of various species and age groups of animals, both domestic and wild, in limited areas that favor the accumulation of parasitic agents, contribute to the formation of foci of ecto- and endoparasites common to them [4, 6, 7, 9].

The presence and circulation of pathogenic agents of invasions in the bodies of animals and humans significantly reduce their immunological resistance and make them more susceptible to the pathogenic agents of infectious diseases, favoring their development, with serious consequences for public health and the national economy [5, 8, 10].

In recent decades, specialists in the Republic of Moldova have registered multiple parasitic diseases in both the public livestock sector and wildlife, which pose a danger to both animal and public health. These include echinococcosis, trichinosis, cysticercosis, fascioliasis, toxocarosis, strongyloidiasis, dicroceliasis, ascariasis, toxoplasmosis, sarcocystosis, coccidiosis, etc. [2, 11].

The damage caused by parasitic diseases in animals is not comparable to that in public health. Many of these diseases are difficult to diagnose in humans, often remain undetected for long periods, are practically untreatable, and ultimately lead to disability or even death [3, 11].

An incorrect diagnosis leads to improper prophylaxis or therapy. Therapy directed only against one of the parasites generates negative

*State University of Moldova, Institute of Zoology, Republic of Moldova, Chișinău, e-mail: rusus1974@yahoo.com;

**Technical University of Moldova, Faculty of Veterinary Medicine, Republic of Moldova, Chișinău, e-mail: nicolainafornita@gmail.com

effects. Often, treating only one of the agents in a parasitic complex by selecting antibiotics, antihelmintics, or coccidiostats ignores the other parasites. The species in the parasitic complex restructure associations, incorporate new parasites, and thus the structure and impact on the host organism can change [10, 12].

Correct planning and rational organization of antiparasitic measures can only be ensured by acquiring knowledge about the laws of parasitocenosis in both the internal and external environment, as well as the epizootiological particularities of the parasites [2, 11, 13].

The current epizootic situation confirms the need to reconsider comprehensive measures for the prevention of parasitoses in animals. To improve the parasitological situation, it is necessary to develop a national comprehensive program for the prevention and control of parasitic diseases in wild animals.

According to preliminary calculations and in accordance with scientific data, the annual economic damage at the national level caused by parasitoses in livestock amounts to approximately 2 billion lei. These enormous losses can be prevented through a comprehensive program of prevention and treatment of these parasitic diseases [2, 3, 11, 12, 14].

In the Republic of Moldova, helminth-protozoan parasitocenoses are quite widespread in both livestock and wild animals (in some cases up to 100%). Only through a deep understanding of their systematics, biology, and ecology, as well as the types of interconnections between the components of the parasitic complex and their action on the host organism, will it be possible to develop effective methods for prophylaxis and treatment that will reduce economic losses in the veterinary sector. It has been observed that, in recent decades, the extent of invasion by ecto- and endoparasites, in the form of mono- and polyinvasions, has increased compared to previous years, and depends on factors such as the age of the animals, the maintenance technology, the growing area, and other factors. According to the bibliographic study on the spread of polyparasitism in cattle, this biological phenomenon is very widespread, practically in all regions of the world, representing a permanent source of infestation for both humans and animals [2, 3, 4, 7, 8, 9, 10, 11].

Material and method

Investigations regarding the determination of the parasitic fauna in wild animals were conducted in the Parasitology and Helminthology Laboratory of the Institute of Zoology of the Academy of Sciences of Moldova. Biological samples were collected from wild animals (red deer, spotted deer, roe deer, wild boars, field rabbits), as well as from foxes, in the natural reserves "Codrii", "Plaiul

Fagului", "Pădurea Domnească", and from domestic animals (cattle, sheep) in areas where natural ecosystems intersect with anthropogenic ones in the Central and Northern regions of the Republic of Moldova.

To achieve the proposed objectives, various methods were used, including coproscopic methods (Fulleborn, Darling), coprolarvoscopic methods (Popov, Baermann), special examination for sarcocystosis using the Kakurin method, partial parasitological investigations (according to K. I. Skrjabin), and successive washing techniques. The intensity of invasion by nematodes, Fasciola eggs, microcoelids, and oocysts of *Eimeria* was determined in 5g of feces, using 10 microscopic fields (10x40 magnification).

Results and discussions

In order to achieve the proposed objectives, parasitological investigations were carried out on wild mammals (European bison, red deer, spotted deer, roe deer, wild boar, fox, pine marten, field rabbit) and domestic animals (cattle, sheep) from areas where natural ecosystems intersect with anthropogenic ones in the Central and Northern regions of the Republic of Moldova: the natural reserves "Codrii", "Plaiul Fagului", "Pădurea Domnească".

In the "Codrii" natural reserve, 62 biological samples were examined from spotted deer, 47 from red deer, 76 from roe deer, 88 from wild boar, 35 from foxes, 24 from pine martens, and 53 from field rabbits. A total of 17 species of parasitic agents were identified, including 2 species of trematodes, 6 species of nematodes, and 9 species of protozoa (Table 1).

It was found that red deer were infested with 5 species of parasites (2 species of trematodes, 1 nematode, and 2 protozoa): *Fasciola hepatica*, *Dicrocoelium lanceolatum*, *Strongyloides papillosus*, *Eimeria asymmetrica*, *Eimeria austriaca*;

Spotted deer were infested with 5 species of parasites (2 species of trematodes, 1 nematode, and 2 protozoa): *Fasciola hepatica*, *Dicrocoelium lanceolatum*, *Strongyloides papillosus*, *Eimeria asymmetrica*, *Eimeria austriaca*;

Roe deer were infested with 5 species of parasites (2 species of trematodes, 1 nematode, and 2 protozoa): *Fasciola hepatica*, *Dicrocoelium lanceolatum*, *Strongyloides papillosus*, *Eimeria capreoli*, *Eimeria ponderosa*;

Wild boars were infested with 4 species of parasites (1 trematode, 2 nematodes, and 1 protozoan): *Dicrocoelium lanceolatum*, *Strongyloides ransomi*, *Metastrongylus elongatus*, *Eimeria deblickei*;

Foxes were infested with 3 species of parasites (2 nematodes and 1 protozoan): *Strongyloides stercoralis*, *Toxocara canis*, *Eimeria vulpis*.

Pine martens were infested with 1 species of nematode: *Strongyloides tumefaciens*, and field rabbits were infested with 5 species of parasites (1 trematode, 1 nematode, and 3 protozoa):

Dicrocoelium lanceatum, *Strongyloides papillosum*, *Eimeria leporis*, *Eimeria simiculpta*, *Eimeria robertsoni*

Table 1 - Infestation level of wild animals in the "Codrii" nature reserve

Invasion	Animal species							
	Red deer, %	Sika deer, %	Roe deer, %	Wild boar, %	Fox, %	Pine marten, %	European brown hare, %	Cattle, %
<i>Dicrocoelium lanceatum</i>	12.8	14.9	20.1	3.6	-	-	28.2	45.8
<i>Fasciola hepatica</i>	9.5	10.2	3.2	-	-	-	-	33.3
<i>Strongyloides ransomi</i>	-	-	-	72.3	-	-	-	-
<i>Strongyloides papillosum</i>	88.0	79.8	89.4	-	-	-	59.4	54.2
<i>Strongyloides stercoralis</i>	-	-	-	-	55.9	-	-	-
<i>Strongyloides tumefaciens</i>	-	-	-	-	-	59.6	-	-
<i>Eimeria spp.</i>	28.2	22.4	38.1	46.3	18.9	37.4	-	37.5
<i>Metastrongylus elongatus</i>	-	-	-	87.5	-	-	-	-
<i>Toxocara canis</i>	-	-	-	-	44.9	-	-	-
Total cercetat	47	62	76	88	35	24	53	24

As a result of coproscopic investigations in animals from the "Codrii" natural reserve, it was found that the red deer (*Cervus elaphus*) was infested with *Dicrocoelium lanceolatum* (12.8%), *Fasciola hepatica* (9.5%), strongylid larvae (88.0%), and *Eimeria spp.* oocysts (28.2%); the spotted deer (*Cervus nippon*) was infested with *D. lanceolatum* (14.9%), *F. hepatica* (10.2%), strongylid larvae (79.8%), and *Eimeria spp.* oocysts (22.4%); the roe deer (*Capreolus capreolus*) was infested with *D. lanceolatum* (20.1%), *F. hepatica* (3.2%), strongylid larvae (89.4%), and *Eimeria spp.* oocysts (38.1%). In wild boars, an infestation level with *Dicrocoelium lanceolatum* was found in 3.6% of cases, *Strongyloides ransomi* larvae in 72.3%, *Metastrongylus elongatus* in 87.5%, and *Eimeria spp.* (46.3%). In field rabbits, an infestation level was recorded with *D. lanceolatum* (28.2%) and *Strongyloides papillosum* (59.4%).

From the adjacent areas of the reserve, biological samples were collected from cattle grazing in these territories. In this regard, 24 samples were collected. Coprological investigations revealed *Fasciola* eggs in 8 (33.3%) samples, *dicrocoelids* in 11 (45.8%), strongylid larvae in 13 (54.2%), and *Eimeria* oocysts in 9 (37.5%) samples. It was found that infested animals in 95-100% of the cases were polyparasitic.

To determine the level of infestation in wild mammals kept in the "Plaiul Fagului" Natural Reserve, biological samples were collected from roe deer (13 samples), red deer (16 samples), spotted deer (10 samples), wild boar (12 samples), and one field rabbit. In the animals examined, 19 species of parasitic agents were identified, including one species of cestode, 3 species of trematodes, 11 nematodes, and 4 species of protozoa (Table 2).

Table 2 - Infestation level of wild mammals maintained in the "Plaiul Fagului" nature reserve in the Republic of Moldova

Invasion	Animal species				
	Red deer, %	Sika deer, %	Roe deer, %	Wild boar, %	European brown hare, %
<i>Moniezia benedeni</i>	12.5	10.0	15.4	-	-
<i>Fasciola hepatica</i>	25.0	10.0	15.4	-	-
<i>Dicrocoelium lanceatum</i>	12.5	30.0	-	16.7	+
<i>Paramfistomum cervi</i>	-	-	15.4	-	-
<i>Strongyloides papillosum</i>	100.0	100.0	100.0	-	+
<i>Strongyloides ransomi</i>	-	-	-	100.0	-
<i>Cooperia punctata</i>	6.3	10.0	23.1	-	-
<i>Ostertagia ostertagi</i>	6.3	10.0	7.7	-	-
<i>Metastrongylus elongatus</i>	-	-	-	8,3	-
<i>Toxocara vitulorum</i>	18.8	10.0	15.4	-	-
<i>Trichostrongylus axei</i>	6.3	-	-	-	-

<i>Ascaris suum</i>	-	-	-	83.3	-
<i>Hyostrongylus rubidus</i>	-	-	-	8.3	-
<i>Trichocephalus suis</i>	-	-	-	8.3	-
<i>Macracanthorhynchus hirudinaceus</i>	-	-	-	8.3	-
<i>Eimeria asymmetrica</i>	6.3	-	-	-	-
<i>Eimeria austriaca</i>	6.3	-	-	-	-
<i>Eimeria capreoli</i>	-	-	61.5	-	-
<i>Eimeria ponderosa</i>	-	-	61.5	-	-
Total cercetat	10	7	9	7	2

It was found that red deer (*Cervus elaphus*) were infested with 10 species of parasites (1 cestode, 2 trematodes, 5 nematodes, and 2 protozoa): *Moniezia benedeni*, *Fasciola hepatica*, *Dicrocoelium lanceatum*, *Strongyloides papillosus*, *Cooperia punctata*, *Ostertagia ostertagi*, *Toxocara vitulorum*, *Trichostrongylus axei*, *Eimeria asymmetrica*, *Eimeria austriaca*.

Spotted deer (*Cervus nippon*) were infested with 7 species of parasites (1 cestode, 2 trematodes, 4 nematodes): *Moniezia benedeni*, *Fasciola hepatica*, *Dicrocoelium lanceatum*, *Strongyloides papillosus*, *Cooperia punctata*, *Ostertagia ostertagi*, *Toxocara vitulorum*.

Roe deer (*Capreolus capreolus*) were infested with 9 species of parasites (1 cestode, 2 trematodes, 4 nematodes, and 2 protozoa): *Moniezia benedeni*, *Fasciola hepatica*, *Paramfistomum cervi*, *Strongyloides papillosus*, *Cooperia punctata*, *Ostertagia ostertagi*, *Toxocara vitulorum*, *Eimeria capreoli*, *Eimeria ponderosa*.

Wild boars (*Sus scrofa*) were infested with 7 species of parasites (1 trematode, 6 nematodes): *Dicrocoelium lanceatum*, *Strongyloides ransomi*, *Metastrongylus elongatus*, *Ascaris suum*, *Hyostrongylus rubidus*, *Trichocephalus suis*, *Macracanthorhynchus hirudinaceus*.

Field rabbits were infested with 2 species of parasites (1 trematode, 1 nematode): *Dicrocoelium lanceatum*, *Strongyloides papillosus*.

The results obtained show that 80.8% of the animals examined were infested with mixed invasions, in various associations ranging from 2 to 5 parasitic agents.

To determine the parasitic fauna of the European bison in the "Pădurea Domnească" Nature Reserve, biological samples were collected from 3 adult bison and 2 young bison kept in captivity. In order to assess the level of infestation of domestic animals from the adjacent area of the "Pădurea Domnească" Nature Reserve, biological samples were also collected, and coproscopic and coprolarvoscopic investigations were conducted (Table 3).

From the adult bison, 9 biological samples were collected, from the young bison – 8 samples, 2 samples from cattle, 6 from sheep, and 1 from a horse from the adjacent area.

It was found that in the adult bison, 6 species of parasites were identified (1 trematode, 2 nematodes, 3 protozoa): *Fasciola hepatica*, *Strongyloides papillosus*, *Trichocephalus globulosa*, *Eimeria bovis*, *Eimeria auburnensis*, *Eimeria ellipsoidalis*, while in the young bison, 3 species were identified (1 trematode, 1 nematode, 1 protozoan): *Fasciola hepatica*, *Strongyloides papillosus*, *Eimeria bovis*.

It was observed that the adult bison had a very high intensity of infestation with *Strongyloides papillosus*, while the young bison had a high intensity of infestation with both *S. papillosus* and *F. hepatica*. Regarding polyparasitism, the adult bison were polyparasitized with *F. hepatica*, *S. papillosus*, *Trichocephalus globulosa*, *Eimeria bovis*, *E. auburnensis*, *E. ellipsoidalis*, while the young bison were infested with *F. hepatica*, *S. papillosus*, and *E. bovis*.

Table 3 - Infestation of european bison and domestic animals in the adjacent area of the "Pădurea Domnească" nature reserve

Invasion	Animal species				
	EUROPEAN BISON		DOMESTIC ANIMALS		
	Adults	Young	Cattle	Sheep	Equine
<i>Moniezia expansa</i>	-	-	-	+	-
<i>Fasciola hepatica</i>	+	+	+	+	-
<i>Strongyloides papillosus</i>	+	+	+	+	-
<i>Strongyloides westeri</i>	-	-	-	-	+
<i>Trichocephalus globulosa</i>	+	-	-	-	-

<i>Oxyuris equi</i>	-	-	-	-	+
<i>Eimeria zuernii</i>	-	-	+	-	-
<i>Eimeria bovis</i>	+	+	+	-	-
<i>Eimeria auburnensis</i>	+	+	-	-	-
<i>E. ellipsoidalis</i>	+	-	+	-	-
<i>Eimeria parva</i>	-	-	-	+	-
<i>Eimeria faurei</i>	-	-	-	+	-
Total specii	6	3	5	5	2

Cattle were infested with 5 species of parasites (1 trematode, 1 nematode, 3 protozoa): *F. hepatica*, *S. papillosus*, *Eimeria bovis*, *E. zuernii*, *E. ellipsoidalis*. Sheep were infested with 5 species (1 cestode, 1 trematode, 1 nematode, 2 protozoa): *Moniezia expansa*, *F. hepatica*, *S. papillosus*, *Eimeria parva*, *E. faurei*, while horses were infested with 2 species of nematodes: *S. westeri* and *Oxyuris equi*.

Conclusions

1. The results obtained demonstrate that the parasitic fauna established in wild animals (red deer, roe deer, bison), in general, corresponds to that of domestic mammals (cattle, sheep), which grazed in the adjacent areas.
2. The identified parasitic agents can be divided into two groups: obligatory for wild mammals and common to both wild and domestic animals.
3. In red deer, 10 species of parasites were identified, of which 3 are obligatory for them, and 7 species are common to both cattle and sheep.
4. Spotted deer were infested with 7 species of parasites, of which 2 are obligatory for them, and 5 species are common to both cattle and sheep.
5. Roe deer were infested with 10 species of parasites, of which 2 are obligatory for them, and 8 species are common to both cattle and sheep.
6. In bison, 6 species of parasites were identified, of which 1 is obligatory for them, and 5 species are common to both cattle and sheep.
7. Wild boar were infested with 7 species of parasites, of which 1 is obligatory for them, and 6 species are common to domestic pigs.
8. Foxes were infested with 3 species of parasites, of which 1 is obligatory for them, and 2 species are common to dogs and cats.
9. Martens were infested with a single species of parasite that is common to other carnivores.
10. Field rabbits were infested with 5 species of parasites, which are common to domestic rabbits.
11. The high level of infestation in wild ruminants with fascioles, dicrocoeliids, gastrointestinal and pulmonary strongylosis, protozoa, as well as the presence of intermediate and complementary hosts, once again demonstrates their role in maintaining the epizootic cycle of these diseases and their significant

impact on the infestation of domestic animals in the respective localities.

12. Recent parasitological studies conducted on domestic and wild animals show that the situation has reversed; wild mammals and domestic animals now infect each other with various parasitic agents while grazing in common areas.

13. Therefore, intervention to interrupt the trophic chain of parasitic agents is possible through the development of new antiparasitic measures, but this requires knowledge of the biological characteristics of the parasites, their hosts, and the surrounding environment.

Rezumat

Studiul diversității faunei parazitare la animalele sălbatice și domestice din diferite biotopuri naturale și antropice din Republica Moldova a permis identificarea faptului că 80,8% dintre aceste animale erau infestate cu forme mixte de paraziți, în asociații diverse, de la două până la cinci agenți parazitari. Rezultatele obținute sugerează că fauna parazitară a animalelor sălbatice (cerți, căpriori, zimbri) corespunde, în mare măsură, cu fauna parazitară a animalelor domestice (bovine, ovine). Analiza datelor parazitologice arată că agenții parazitari pot fi împărțiți în două grupe: cei obligatorii pentru animalele sălbatice și cei comuni atât pentru animalele sălbatice, cât și pentru cele domestice. Nivelul ridicat de infestare a rumeștoarelor sălbatice cu fasciola, dicrocoeliu, strongiliile intestinale și pulmonare, precum și prezența gazdelor intermediare și complementare demonstrează din nou că aceste parazitoze participă la menținerea lanțului epizootic al bolilor și au un impact semnificativ asupra infestării animalelor domestice. Astfel, mediul înconjurător joacă un rol important în menținerea lanțului epizootic al infecțiilor parazitare. Cercetările parazitologice recente efectuate la animalele domestice și sălbatice din Moldova relevă faptul că animalele sălbatice și cele domestice se infestază reciproc cu diverși agenți parazitari în timp ce pasc pe pășuni comune.

Acknowledgements

The investigations were carried out with the support of the institutional project - State Program with the theme: "Diversity of hematophagous arthropods, zoo- and phytohelminths, vulnerability and strategies for tolerance to climatic factors. Development and implementation of innovative methods for the integrated control of species of community interest", with the code: 20.80009.7007.12 F, and the Subprogram with the code 010701 "Assessment of the structure and functioning of biocenoses, aquatic and terrestrial habitats under the influence of biotic and abiotic factors in the context of ensuring ecological security and the well-being of the population", within the State University of Moldova.

References

1. BIANCHI A., MATTIELLO S., REDAELLI W. 1996 - Primi risultati di un'esperienza di controllo centralizzato su ungulati abbattuti in un settore di caccia alpino. *Supplement ric. biol. selvagg.* Bologna, 24. - P.645-652.
2. Erhan D. 2020 - *Tratat de parazitoze asociate ale animalelor domestice.* Chişinău, Tipografia centrală. 1040 p. ISBN 978-9975-157-13-1.
3. ERHAN D., SPASSKY A., LUNCAŞU M. 1996 - Prevenirea răspândirii zooparaziţilor din fermele zootehnice în biotopurile naturale. In: *Revista Română de Parazitologie.* Al VI-lea Simpozion Naţional de Parazitologie pe tema: „Ecologia paraziţilor şi implicaţii ale parazitozelor”. Sibiu, 30-31 mai 1996, vol.VI, nr. 1-2, pp. 87. ISSN 1221-1796.
4. ERHAN D., TODERAŞ I., RUSU Ş., ZAMORNEA M., 2014 - Diversitatea parazitofaunei Zimbrilor din Rezervaţia Naturală „Pădurea Domnească” şi animalelor domestice din zona adiacentă. *Buletinul Academiei de Ştiinţe a Moldovei. Ştiinţele vieţii.*, nr. 1 (322), 103-111. ISSN 1857 064X.
5. HUDSON P., 1996 - Ecopatologia fauna silvatica. *Supplement ric. biol. selvagg.* Bologna, - 24. - P. 5-16.
6. OLTEANU G., ş.a. Parazitoozoote. 1999 - *Probleme la sfârşit de mileniu în România.* Editura "Viaţa medicală românească", Bucureşti, 592 p. ISBN 973-9320-25-2.
7. RUSU Ş., et al. 2013 - Domestic animals – the source for poliparasitic poisoning of pastures. *Actual Problems of Protection and Sustainable of The animal World Diversity.* VIIIth International Conferences of Zoologists. Chisinau, P. 164-165. ISBN 978-9975-66-361-8.
8. RUSU Ş., ş. a. 2020 - *Parazitofauna, impactul parazitozelor asupra organismului la fazanul comun (Phasianus colchicus L.), profilaxia şi tratamentul.* (Ghid Metodologic). Chişinău., 80 p. ISBN 978-9975-151-89-4.
9. RUSU Ş., 2020 - The diversity of the pheasant parasitofauna from various natural and anthropized biotopes of the Republic of Moldova. *Buletinul AŞM. Ştiinţele vieţii.* Nr. 2(341). P.108-118. ISSN 1857 – 064 X.
10. RUSU Ş., ERHAN D., 2019 - *Fauna parazitară a mamiferelor sălbatice din Rezervaţia Naturală „Pădurea Domnească” din Republica Moldova //Materialele Simpozionului Ştiinţific Internaţional "45 ani de învăţământ superior medical veterinar din Republica Moldova", 24-26 octombrie 2019, Chişinău, p. 500-506. ISBN 978-9975-64-310-8.*
11. RUSU Ş., 2021 - *Parazitofauna, impactul parazitozelor asupra speciilor principale de importanţă cinegetică, profilaxia şi tratamentul.* - Chişinău: S.n., (Lexon-Prim SRL). - 492 p.: ISBN 978-9975-163-04-0.
12. ŞUTEU I., COZMA V., GHERMAN C. 2003 - Probleme actuale privind profilaxia antiparazitară a ecosistemelor. In: *Culegerea „Ecologia, evoluţia şi ocrotirea diversităţii regnului animal şi vegetal”,* Chişinău, , pp. 239-246. ISBN: 997597743X
13. БЕРЕЖНОЙ Д.В., РОМАНЕНКО П.Т., ЗВЯГИНЦЕВА Н., 1995 - Паразитоценозы диких и домашних копытных животных государственного степного заповедника „Аскания - Нова”. Материалы докл. научн. конф. „Ассоциативные паразитарные болезни, проблемы экологии и терапии”. Москва, -С.20-21.
14. КРАСКОВ Н.Т., АТАЕВ А.М., ЗУБАЙРОВ М.М. И ДР. 2008- Распространение гельминтозов домашних и диких жвачных в Дагестане //Российский паразитологический журнал. №3, С.56-59.