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Ecological And Pathophysiological Basis For The Functioning Of The Parasitic System In Sheep Estrosis.

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ABSTRACT

This article presents the distribution data in the Stavropol Territory of the Russian Federation estrosis in sheep, the causative agents of which are the parasitic larvae of Oestrusovis (Linnaeus 1758). Ecological and pathophysiological bases of the parasitic system functioning are described.
Keywords: myasis, parasitic larvae, sheep, environmental indicators, pathophysiological changes, the host organism.

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INTRODUCTION

Estrosis (gadfly) sheep is widespread. Extensiveness of gadfly invasion in sheep in the Stavropol Territory varies between 78-95%, the intensity of invasion is an average of 22-27 specimens of parasitic gadfly larvae per animal. In the southern regions of the Russian Federation, estrosis causes significant economic damage to sheep, due to a decrease in meat and wool productivity in invasive animals. In patients with estrosis of ewes, a weakened population of lambs is born, which is easily exposed to diseases of a contagious and non-contagious etiology, and in the absence of medical aid they die.

Taxonomy. The estrosis pathogen in sheep is the parasitic gadfly Oestrusovis (Linnaeus 1758). Sheep gadfly (Oestrusovis) is a member of the genus Oestrus, family Oestridae, order Diptera, class Insecta.

In recent years, research on parasitic systems has been increasingly published in modern scientific literature. A significant amount of applied and fundamental research has been performed. The following are studied: morphology, biology, laboratory diagnostics, pathogenicity of pathogens of infectious diseases [11, 12, 13, 5], molecular bases of parasitism [10], biocenotic relations, evolutionary genetic theory of parasitism [1, 2, 8], evolution of parasites; structure, strategy, processes of self-regulation of population size and stability of parasitic systems [9, 6, 7, 3, 4]. Ecological, pathological, immunological, and metabolic concepts have been developed, which present the features of the functioning of parasitic systems, determine the pathogenetic essence of the effects of various types of parasites on the host organism. It should be noted that during estrosis, the parasitic image is inherent in the larval stages, and the imago are free-living. Parasitism of this kind is called larvial. The study of the biology, ecology and phenology of nasopharyngeal gadflies and the characteristics of the functioning of the parasitic system during estrosis is important for understanding the evolution of the parasites of this group. Of particular importance are questions of the biology of the pathogens of estrosis, depending on the life cycle of the host and its responses to the introduction of parasitic gadfly larvae, knowledge of which creates the prerequisites for developing effective measures to combat this disease.

The parasite's habitat is divided into a first-order environment, i.e., the host organism, and a second-order environment external to the host. The study of parasites, many of which are evolutionarily related to certain groups of hosts, determines important additional criteria for establishing phylogeny and ways of forming fauna of hosts.

The study of the systemic interactions of parasites with the host in constantly changing environmental conditions creates prerequisites for understanding the pathogenetic essence of the impact of Oestrusovis preimaginal phases on hosts, their settlement, migrations, and biocenotic relations.

The relevance of the research carried out is due to the need to study the pathogenetic basis of the parasitic system functioning in the estrosis of sheep, which are currently not well understood.

The purpose of research. The task was to determine the pathogenetic essence of the influence of sheep gadfly's parasitic larvae on the host organism, based on a systematic study of biology, environmentalists of the adult and O. ovis preimaginal phases in order to identify the most vulnerable links in the population development of parasites and develop on this basis an effective system to combat sheep estrosis.

MATERIALS AND METHODS

The object of the research was sheep, spontaneously infested by O. ovis larvae. In the steppe zone of the Stavropol Territory, sheep are exposed to annual infestation by larvae of abdominal gadfly in early spring (March – April) until late autumn (October – November). During this time, the larvae of O. Ovis pass through three stages of development in the host’s body and enter the environment for pupation. In the process of research, we studied the morphological composition of blood in invasive animals. Conducted: head opening, differentiated selection of larvae of sheep gadfly of all stages of development, recorded the number in the places of their localization.

RESULTS AND DISCUSSION

Localization and metamorphosis of the preimaginal phases of O. ovis. Studies were carried out monthly (throughout the year) by opening the heads of dead and fallen sheep, which allowed us to track the dynamics of the metamorphosis of the O. ovis larvae of summer and winter generations. Found that the timing of infection of sheep depends on the climatic conditions of the research area. The development of spring generation in O. ovis continues until the third decade of July.

It was established that from the second or third decade of July to September-October of the current year, the second generation of the cavity gadfly is developing (or partially delayed in development). The delay in the development of the second generation of the cavity gadfly seems to be due to the peculiarities of interpopulation interactions in the parasitic system, intrapopulation mechanisms of regulation of the population of parasites in the host population. Autumnal infection of sheep with larvae of the gadfly occurs from September to December. With a decrease in air temperature to -3 degrees, a massive death of winged gadflies was observed. According to our data, the larvae of the sheep gadfly of the first stage of development are on the mucous membrane of the nasal cavity of animals in a state of anabiosis until the third decade of December. In the noted period, they are very vulnerable and it is precisely in these terms that treatment and preventive measures should be carried out. The most appropriate method of combating sheep estrosis at this time is intranasal administration of drugs.

In January-February, some of the O. ovis larvae molt into the second stage, and in March-April into the third. The third stage larvae, in turn, go through two stages of development - not pigmented, lasting 5 - 10 days and pigmented - 6 - 7 days, which indicates the completion of the metamorphosis of the larval O. ovis phases.

At the end of development, the third stage larvae enter the environment. The pigmented larvae of a sheep gadfly that have escaped from the nasal passages migrate over the soil surface for a long time, and then (depending on the density of the upper soil layer) penetrate into it to a depth of 3 to 10 cm and pupate. The duration of the pupa phase is 14–16 days. After emerging from the puparia, the O. ovis omago mates. Fertilized females for 10 days (the period of maturation of the larvae) do not show activity. They are located in the cracks, cracks of livestock buildings. During this period, prerequisites are created for the destruction of winged gadflies. Veterinary specialists treat the wall surfaces of the buildings with solutions (insecticide emulsions), upon contact with which a “seed” occurs and the subsequent death of insects. Mass accumulations of O. ovis adults on livestock facilities are usually recorded in May-June and October-November. These terms are optimal for the extermination of O. ovis females. It is more expedient to carry out surface treatment of the walls of livestock buildings with photostable synthetic pyrethroids whose residual effect lasts up to 14 weeks. It is important to note that the destruction of fertilized females helps to reduce the population of gadflies, which naturally leads to a decrease in the extensiveness of gadfly invasion in sheep.

The metamorphosis of the preimaginal phases of O. ovis is carried out in stages and is regulated, in our opinion, by the peculiarities of the functioning of the parasitic system in each individual case, subject to evolutionary patterns.

The scientific and practical significance of the data presented is the possibility of adjusting the tactics of using insecticides and larvicides during the development of the third stage gadfly larvae. We believe that the treatment of animals during this period (March-April) should be carried out with caution due to the fact that the mass death of parasites under the action of drugs will facilitate the entry into the host organism of somatic antigens and the implementation of allergic hypersensitivity reactions of immediate or delayed types with possible for sheep fatal.

Morphological and biochemical composition of the blood of sheep, infested with O. ovis larvae

Important characteristics of the parasite population, which determine the outcome of interaction with the host population are: the number of individuals, their fecundity, invasive properties, the duration of development of one generation, etc. Their quantitative indicators vary depending on environmental conditions in response to the introduction of the parasite . In the case of estrosis, a close relationship is demonstrated between the estrosis pathogens and the host. The larvae of O. ovis not only are in metabolic dependence on the parasite carrier, but also live off the latter, causing harm to it. They took into account that the larvae of O.ovis are of considerable size and complex morphophysiological organization, secrete metabolic and somatic antigens, which largely determine the intensity of host responses and the outcome of the disease. The host is a habitat for the larvae, the development of parasites causes the transformation of the homeostasis of the host organism without, however, leading to its death.

Studies of patients with sheep estrosis were performed during the development of the summer generation of sheep gadfly. Blood from animals was taken before infection and after at intervals of 15, 30 and 45 days. During this time, the larvae developed from the first to the third stages and exited for pupation into the environment. We have formed three groups of (1,2,3) sheep, in which the intensity of estrous invasion was 10, 20 and 40 larvae per animal, respectively. Evaluation of the hematological profile in patients with sheep estrosis, depending on the intensity of invasion, creates prerequisites for differentiating the levels of pathogenic effects of the O. ovis larval phases in their population development (Table 1).

Table 1: Indicators of the morphological composition of blood in sheep, invaded by O. ovis larvae

Indicators	№ groups	specimens / heads.	Research time (M±m), n=15			
			to experience	after 15 days	after 30 days	after 145 days
Erythrocytes, mln. / ml	1	10	7,6±0,2	7,5±0,4	7,6±0,23	7,5±0,1
	2	20	7,5±0,3	7,4±0,1	7,4±0,3	7,3±0,1
	3	40	7,6±0,1	7,5±0,2	7,1±0,1	6,8±0,3
Leukocytes, thousands	1	10	7,1±0,2	7,2±0,1	7,5±0,4	7,8±0,2
	2	20	7,2±0,2	8,3±0,3	8,5±0,1	8,6±0,2
	3	40	7,2±0,1	8,7±0,2	8,8±0,2	9,0±0,3
Hemoglobin, H%	1	10	8,6±0,3	8,5±0,2	8,6±0,1	8,6±0,3
	2	20	8,3±0,2	8,3±0,2	8,1±0,3	8,1±0,1
	3	40	8,6±0,3	8,4±0,3	7,3±0,1	7,5±0,2
Color indicator of blood	1	10	0,37	0,37	0,38	0,37
	2	20	0,37	0,36	0,37	0,38
	3	40	0,39	0,40	0,37	0,42
Average hemoglobin content	1	10	11,2	11,1	11,1	11,1
	2	20	11,3	11,2	11,3	11,3
	3	40	11,4	11,5	11,5	12,1

The results of the studies showed that in sheep of the first and second groups there were no significant changes in the morphological composition of the blood during the entire observation period.

A significant decrease in the number of erythrocytes was observed in animals of the third group after 30 and 45 days, respectively, by 6.6% and 10.6%. Hemoglobin was reduced after 45 days of observations in an ovum of this group by 12.8%. A significant increase in the number of leukocytes was noted in animals of the second group after 30 and 45 days, respectively, by 18.0% and 19.4%. In sheep of the third group, an increased number of leukocytes were recorded during the entire observation period. After 15, 30 and 45 days, this indicator increased by 20.8%, 22.8% and 25.0%. The color indicator of blood and the average hemoglobin content in one erythrocyte in invasive sheep did not change. In assessing the morphological composition of the blood of great importance is the differential calculation of blood cells (Table 2).

Table 2: Leukogram of sheep infested with O. Ovis larvae

Study time	Neutrophils			B	E	M	L
	Y	P	S				
group 1 n=5							
To experience	0,1±0,1	283±0,4	2843±1,0	33±0,2	432±0,1	211±0,2	3190±0,1
After 15	2,5±0,1	285±0,5	2890±0,1	35±0,1	429±0,1	217±0,2	3215±0,2
30	1,7±0,1	290±0,3	2909±0,3	38±0,1	546±0,3	222±0,1	3205±0,1
45 days	2,0±0,1	298±0,3	2945±0,2	37±0,2	455±0,2	233±0,3	3216±0,2
group 2 n=5							
To experience	0,2±0,1	277±0,2	2915±1,1	39±0,3	512±0,2	232±0,2	3232±0,3
After 15	1,0±0,2	285±0,1	3111±0,2	40±0,1	485±0,1	225±0,2	3344±0,2
30	1,3±0,1	313±0,3	3248±0,3	47±0,2	523±0,2	<u>233±0,1</u>	3339±0,2
45 days	1,9±0,2	<u>307±0,5</u>	<u>3333±0,2</u>	<u>41±0,1</u>	<u>529±0,3</u>	<u>240±0,2</u>	<u>3335±0,1</u>
group 3 n=5							
To experience	0,1±0,2	256±0,2	3161±0,3	40±0,1	451±0,3	221±0,1	3131±0,5
After 15	0,2±0,1	267±0,1	3231±0,2	45±0,2	477±0,6	227±0,2	3118±0,3
30	0,3±0,1	<u>283±0,2</u>	<u>3344±0,3</u>	<u>49±0,3</u>	<u>480±0,5</u>	<u>258±0,3</u>	3223±0,2
45 days	2,2±0,3	<u>299±0,1</u>	<u>3513±0,2</u>	<u>43±0,2</u>	<u>483±0,4</u>	<u>257±0,2</u>	<u>3498±0,1</u>

Analysis of leukograms in invasive sheep showed that significant changes in indicators were observed only in animals of the second and third groups of sheep after 30 and 45 days. Established an increase in the number of stab neutrophils in these periods by 10.8% and 16.7%; nuclear segmento - 14.3% and 11.1%; basophils - 5.1% and 7.5%; eosinophils - 3.3% and 6.8%; monocytes - 3.4% and 6.2%; lymphocytes - 3.1% and 11.1%.

Biochemical studies. When studying protein metabolism in sheep of the first and second groups, in the process of experimental observations, significant changes in the studied parameters were not established. Changes in proteinograms were established only in sheep of the third group (Table 3).

Table 3: Components of protein metabolism in sheep infested with O. Ovis larvae

Observation time, days	Total protein g / l	Albumins g / l	Globulins g / l			
			α_1	α_2	β	γ
M±m n=5						
To experience	83,4±0,3	51,7±0,2	1,9±0,1	15,6±0,4	8,0±0,2	22,8±0,3
After 15	82,5±0,2	49,3±0,3	2,0±0,2	14,9±0,3	8,1±0,1	21,1±0,3
30	81,7±0,1	43,4±0,2	2,1±0,3	14,7±0,2	7,9±0,3	23,1±0,2
45	<u>69,5±0,2</u>	<u>31,5±0,3</u>	<u>2,28±0,4</u>	15,0±0,1	<u>15,0±0,1</u>	<u>29,3±0,1</u>

The data in Table 3 indicate that in the third group of sheep, by the 45th day of observation, the total protein content decreased by 7.2%, β-globulins 14.2%, albumin - 19.0%. An increase in γ-globulin by 43.8% was noted. Significant changes in the content of α_2-globulins have not been established.

CONCLUSION

Our data suggest that the maximum changes in the host organism were recorded during the development of third-stage gadfly larvae. It was at this time that parasitic larvae secrete the maximum number of metabolites that have toxic, sensitizing properties. In response to their intake, the host organism responds with a combination of pathochemical and pathophysiological reactions aimed at inhibiting the vital activity of the parasites or their elimination.

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