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EIMERIA-STRONGYLOID INVASION IN SHEEP IN THE FOOTHILL ZONE OF THE TURKESTAN REGION

Resume. The article presents materials on eimeria-strongyloid invasions of sheep of the Turkestan region. The composition of the parasitocenosis in sheep in the foothill zone of the Turkestan region consists of five species of *Eimeria*: *Eimeria faurei*, *E. intricata*, *E. ovina*, *E. ovinoidalis*, *E. parva* and one species of strongyloides: *Strongyloides papillosus*. *Eimeria* and strongyloides in animals are found in the form of moneywise, and in the form of extenuate. The infestation of sheep with *Eimeria*, strongyloid and eimeria-strongyloid invasions depends on the age and season of the year.

Key words: eimeria, strongyloides, combined invasion, sheep, foothill zone, Turkestan oblast.

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ЭЙМЕРИЙНО-СТРОНГИЛОИДНАЯ ИНВАЗИЯ У ОВЕЦ В ПРЕДГОРНОЙ ЗОНЕ ТУРКЕСТАНСКОЙ ОБЛАСТИ

Резюме. В статье представлены материалы по эймерийно-стронгилоидным инвазиям овец Туркестанской области. Состав паразитоценоза у овец в горной зоне Туркестанской области состоит из пяти видов эймерий: *Eimeria faurei*, *E. intricata*, *E. ovina*, *E. ovinoidalis*, *E. parva* и одного вида стронгилоидов: *Strongyloides papillosus*. Эймерий и стронгилоиды в организме животных встречаются как в виде моноинвазий, так и в виде микстинвазий. Зараженность овец эймериями, стронгилоидами и эймерийно-стронгилоидными инвазиями зависят от возраста и сезона года.

Ключевые слова: эймерий, стронгилоиды, смешанная инвазия, овца, предгорная зона, Туркестанская область.

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ТҮРКІСТАН ОБЛЫСЫНЫҢ ТАУ БӨКТЕРІНДЕГІ АЙМАҒЫНДА ҚОЙЛАРДЫҢ ЭЙМЕРИЙЛІ-СТРОНГИЛОИДТІ ИНВАЗИЯСЫ

Түйін. Мақалада Түркістан облысы қойларының эймериялы-стронгилоидты инвазиясы бойынша материалдар ұсынылған. Түркістан облысының қойларында паразитоценоз құрамы бес түрлі эймериядан: *Eimeria faurei*, *E. intricata*, *E. ovina*, *E. ovinoidalis*, *E. parva* және бір түрдегі стронгилоидтан: *Strongyloides papillosus* тұрады. Эймериялар мен стронгилоидтар жануарлар организмінде жеке түрде де және аралас инвазия түрінде де кездеседі. Қойлардың эймериямен, стронгилоидтармен және құрамдас инвазиямен зарарлануы жануарлардың жасына және жыл мезгіліне байланысты.

Түйінді сөздер: эймерий, стронгилоидтар, аралас инвазия, қой, тау бөктері аймағы, Түркістан облысы.

Introduction. Of all the regions of Kazakhstan, the Turkestan region is one of the first places in terms of the number of sheep. Currently, there are more than 4.1 million sheep in the region. Animal husbandry, in particular sheep farming, plays a leading role among other sectors of the economy. Consequently, a large share in the economy of the region is occupied by products obtained from sheep. Protozoa and helminthiasis are one of the limiting factors that prevent obtaining maximum productivity from sheep farming. Compared to the death of sheep from various causes, parasitosis accounts for 15-20 %, and of the losses from all infectious diseases, invasive and infectious, parasitosis accounts for 80-90 %. In Kazakhstan, until recently, eimeriosis [1, 2] and strongyloidosis [3] of sheep are considered and studied separately. At the same time, the authors took into account the influence of parasites on the host body only on any one taxonomic group. However, in production conditions, pathogens of invasive diseases in animals in most cases parasitize in a mixed form [4] and cause associative diseases that occur in a more severe form and cause great economic damage [5]. Studies on the study of parasitocenosis and associative diseases of sheep caused by eimeria, strongyloids have not been conducted in Kazakhstan. The species composition of the joints of the parasitocenosis has not been established. The distribution and seasonal-age dynamics of parasite infestation in animals with combined infestations in various combinations have not been studied.

Materials and methods of research. The collection of material in the foothill zone of the Turkestan region was carried out in 2008-2019 from 360 sheep in the peasant farm «Namazgoy» of the rural county of Zhana Ikan of the Turkestan district. In Vivo parasitological studies of sheep were carried out according to the method of O.Berkinbay [6]. Fecal samples (3 g) were taken from the rectum of the same animals. The feces were placed in paper bags and treated on site, or placed in penicillin vials and preserved with a 2.5 % solution of potassium bicarbonate for further processing in the university laboratory. The feces were thoroughly rubbed in a porcelain cup with 15-20 ml of water. The suspension was filtered through a metal sieve or cheesecloth and centrifuged for 5 minutes at 1000-1500 revolutions per minute. Then the top layer of the liquid was drained, and solutions of zinc chloride or lead nitric acid with a specific gravity of 1.598 and 1,500, respectively, were added to the sediment. The precipitate was thoroughly mixed and centrifuged again for 1 minute at 1000 rpm. Then the top film was removed from the liquid with a wire loop, applied to a slide, drops of distilled water were added, covered with a cover glass and microscoped. The species identity of Eimeria was determined on the basis of morphological features of oocysts (shape, size, color, thickness and structure of the shell, the presence of micropile, polar cap, residual body and light-refractive bodies), sporocysts (shape, size, presence of residual body and stid bodies), sporo-

zoites (shape, size, presence of light-refractive bodies) and the time of sporulation of oocysts. At the same time, the data of S.K.Svanbaev [6] and O.Berkinbay [7] were also taken into account. When determining the eggs of strongyloids, the shape, size, color, thickness and structure of the shells were taken into account; corks at the poles, crushing balls or larvae in the center of nematodes.

Main results of research papers. Eimeria and strongyloids in the body of animals were found both in the form of monoinvasia and in the form of mixed infestations.

Next, the exposed material, initially shared the invasions, monoinvasia, then mixed infestations. General infection of sheep with Eimeria. When examining 360 sheep, 155 (43.1 %) were infected with eimeria (table 1), in which five eimeria species were identified: Eimeria faurei, E. intricata, E. ovina, E. ovinoidalis, and E. parva. Our studies have shown that the overall infection of sheep with eimeria depends on age. Young animals are more infected than adult animals. High rates of extensiveness (54.2 %) and intensity (11.4 oocysts) of invasion in animals were recorded at the age of less than 1 year (table 2). However, as the sheep age, their infestation decreases. Young animals under the age of 2 years are infected by 41.7 %, with II 4.0 oocysts, sheep older than two years - 33.3 %, with II 2.7 oocysts.

The total infection of sheep with eimeria also depends on the season of the year (table 2). The infection of animals in winter is 41.1 % with II 9.0 oocysts, in spring - 34.4 % with II 10.6 oocysts, in summer - 47.8 % with II 3.0 oocysts, in autumn - 48.9 % with II 5.8 oocysts, that is, increased EI is observed in winter, summer and autumn, and II – in spring. In young animals up to a year in all seasons of the year, the EI is increased: in autumn and winter it is 56.7 %, in summer - 50.0 %, in spring - 53.3 %. High II is observed in the spring: 18.3 oocysts, low-in the summer - 2.3 oocysts. In young animals up to two years of age, low EI is observed in spring 33.3 % with II 2.3 oocysts, in autumn (40.0 % with II 4.3 oocysts) and in summer (43.3 % with II 4.8 oocysts), and in winter it increases slightly (50.0 % with II 4.1 oocysts). In adult animals, the lowest infection rate is observed in winter and spring (16.7 % each with II 2.0-2.6 oocysts), then in summer and autumn it increases to 50.0 % with II 2.3-3.4 oocysts. Our data are consistent with those of a number of other researchers [8-10]. The infection of sheep with monenvasia ameriam. In the study of 360 sheep, 71 (19.7 %) eimeria were infected with monoinvasias (table 1) with an II of 7.2 oocysts. The infection of sheep with monoinvasia eimeria depends on the age. Young animals are more infected than adult animals. Increased rates of extensiveness (26.7 %) and intensity (12.6 oocysts) of invasion in animals were recorded at the age of less than 1 year (table 2). However, as the sheep age, their infestation decreases. Young animals under the age of 2 years are infected by 15.8 %, with II 3.1 oocysts, sheep older than two years – 66.7 %, with II 2.4 oocysts. The infection of sheep with monenvasia eimeria depends

on the season of the year. The infection rate of animals in winter and autumn is 14.4 % for II 7.1-6.8 oocysts, in spring - 17.8 % for II 15.6 oocysts, in summer - 32.2 % for II 2.7 oocysts, that is, high EI is observed in summer, and AI-in spring. In young animals up to a year, increased EI is observed in spring and summer (36.7 % each) and II (18.3 oocysts) - in winter, then this indicator decreases in autumn to 20.0 % with II 11.7 oocysts, in winter - 13.3 % with II 18.3 oocysts. In young animals up to two years old in all seasons of the year, EI (10.0-23.3 %) and II (2.2-4.3 oocysts) are low. In adult animals, the lowest infection rate is observed in the spring (3.3 % with II 3.3

oocysts), the highest-in the summer (36.7 % with II 2.4 oocysts). General infection of sheep with strongyloids. When examining 360 sheep, 136 (37.8 %) eggs were infected with strongyloids (table 1) with an II of 7.1 eggs, in which one strongyloid species was identified: Strongyloides papillosus. The infection of sheep with strongyloids depends on the age. Young animals are less infected than adult animals. High rates of extensiveness (42.5-40.8 %) and intensity (11.6-3.8 eggs) of invasion were recorded in animals older than two years (table 2). Animals under a year old are infected by 30.0 %, with an II of 5.3 eggs. The infection of sheep with strongyloids al-

Table 1 - Eimeria, strongyloid, and eimeria-strongyloid infestations in sheep of the foothill zone

| Types of invasions | Number of sheep examined | Number of infected sheep | EI | II | |
|-------------------------------------|--------------------------|--------------------------|------|---------------------|------------------------|
| | | | | in absolute numbers | the ratio of parasites |
| General infection with eimeria | 360 | 155 | 43,1 | 6,8 | 0 |
| Monenvasia eimeria | 360 | 71 | 19,7 | 7,2 | 0 |
| General infection with strongyloids | 360 | 136 | 37,8 | 7,1 | 0 |
| Monenvasia strongyloids | 360 | 51 | 14,2 | 6,3 | 0 |
| Mixed eimeria-strongyloid invasion | 360 | 85 | 23,6 | 6,4:7,6 | 01:01,2 |

Table 2 - Infestation of sheep with eimeria, strongyloid and eimeria-strongyloid infestations in the foothill zone, depending on age

| Types of invasions | Number of sheep examined | Number of infected sheep | EI | II | |
|--|--------------------------|--------------------------|------|---------------------|------------------------|
| | | | | in absolute numbers | the ratio of parasites |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Young animals under the age of 1 year | | | | | |
| General infection with eimeria | 120 | 65 | 54,2 | 11,4 | 0 |
| Monenvasia eimeria | 120 | 32 | 26,7 | 12,6 | 0 |
| General infection with strongyloids | 120 | 36 | 30 | 5,3 | 0 |
| Monenvasia strongyloids | 120 | 3 | 2,5 | 3,3 | 0 |

Continuation of table 2

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|-----|----|------|----------|---------|
| Mixed eimeria-strongyloid invasion | 120 | 33 | 27,5 | 10,3:5,5 | 1,9:1 |
| Young animals aged from 1 to 2 years | | | | | |
| General infection with eimeria | 120 | 50 | 41,7 | 4 | 0 |
| Monenvasia eimeria | 120 | 19 | 15,8 | 3,1 | 0 |
| General infection with strongyloids | 120 | 51 | 42,5 | 11,6 | 0 |
| Monenvasia strongyloids | 120 | 19 | 15,8 | 10,9 | 0 |
| Mixed eimeria-strongyloid invasion | 120 | 32 | 26,7 | 4,4:12,1 | 01:02,7 |
| Adult sheep | | | | | |
| General infection with eimeria | 120 | 40 | 33,3 | 2,7 | 0 |
| Monenvasia eimeria | 120 | 20 | 16,7 | 2,4 | 0 |
| General infection with strongyloids | 120 | 49 | 40 | 3,8 | 0 |
| Monenvasia strongyloids | 120 | 29 | 24,2 | 3,5 | 0 |
| Mixed eimeria-strongyloid invasion | 120 | 20 | 16,7 | 3,3:4,1 | 01:01,2 |

so depends on the season of the year. The infection rate of animals in winter is 48.2 % with II of 13.3 eggs, in spring - 37.8 % with II of 3.3 eggs, in summer - 20.0 % with II of 3.4 eggs, in autumn - 51.1 % with II of 6.3 eggs, that is, high EI is observed in autumn, and II - in winter. In young animals up to a year, a low EI (16.7 % with an II of 3.2-2.6 eggs) is noted in spring and summer, then this indicator increases and reaches a maximum in winter (46.7 % with an II of 2.7 eggs). In young animals up to two years old, the lowest EI of strongyloids is observed in the summer of 26.7 % with an II of 4.4 eggs, the highest - in the winter of 60.0 % with an II of 25.0 eggs). In adult animals, the lowest infection rate is observed in summer (16.7 % with an II of 2.6 eggs), and the highest in spring and autumn (63.3 % with an II of 3.9-4.2 eggs). Our data are consistent with those of other researchers [11-13]. The infection of sheep with monenvasia with strongyloides. In a study of 360 sheep, 51 (14.2 %) strongyloid monoinvasies were infected (table 1) with an II of 6.3 eggs. The infection of sheep with monenvasia with strongyloides depends on the age. Young animals are less infected than adult animals. Low rates of extensiveness (2.5 %) and intensity (3.3 eggs) of infestation in animals were recorded at the age of less than 1 year (table 2). However, as the sheep age, their infestation increases. Young animals under the age of 2 years are infected by 15.8 %, with II 10.9 eggs, sheep older than two years - 24.2 %, with II 3.5 eggs. The infection of sheep with monoinvasia strongyloides also depends on the season of the year. The infection rate of animals in winter is 15.6 % with II of 11.8 eggs, in spring - 21.1 % with II of 3.1 eggs, in summer - 3.3 % with II of 4.2 eggs, in autumn - 16.7 % with II of 5.5 eggs, that is, low EI is observed in summer. Monoinvasia in different sex and age groups of animals is not always recorded. In young animals up to a year, parasites are found in winter, summer and autumn (3.3 % each with an II of 1.0-5.0 eggs). In animals older than a year, monoinvasia is found in all seasons of the year. In young animals up to two years old, the infection rate in winter is 26.7 % with II of 18.5 eggs, in spring - 13.3 % with II of 2.0 eggs, in summer - 3.3 % with II of 3.0 eggs, in autumn - 20.0 % with II of 8.0 eggs. Infection of sheep with mixed eimeria-strongyloid invasions. When examining 360 sheep infected with mixed invasions, 85 (23.6 %) were found (table 1) with II 6.4 oocysts:7.6 eggs, the ratio of parasites was 1 to 1.2, that is, strongyloids outnumbered eimeria by 1.2 times with mixed invasions. The infestation of sheep with mixed invasion depends on the age. Young animals are more infected than adult animals. High rates of extensiveness (27.5 %) and intensity (10.3 oocysts:5.5 eggs, eimeria exceeded by 1.9 times) infestations in animals were recorded at the age of less than 1 year (table 2). However, with age, the infestation of sheep decreases. Animals up to a year were infected by 26.7 %, with an II of 4.4 oocysts:12.1 eggs, that is, strongyloids outnumbered eimerians by 2.7 times. The infestation of sheep with mixed

invasion also depends on the season of the year. The infection rate of animals in winter is 26.7 % with II 10.0 oocysts:14.2 eggs, in spring - 16.7 % with II 5.3 oocysts:3.5 eggs, in summer - 16.7 % with II 3.9 oocysts:3.2 eggs, in autumn - 34.4 % with II 5.4 oocysts:6.7 eggs, that is, increased EI is observed in autumn and winter, and II - in winter. Strongyloids predominate in winter and autumn, and eimeria in spring and summer. In young animals up to a year, the lowest EI is observed in the summer (3.3 % with an II of 3.3 oocysts:2.0 eggs) and in autumn (16.7 % with II 10.8 oocysts:3.2 eggs), then this indicator increases and reaches a maximum in winter (43.3 % with II 18.5 oocysts:2.8 eggs). At the same time, imeria outnumbered strongyloids by 5.2 times. In young animals up to two years of age, the lowest EI with mixed infestations is observed in spring (20.0% with II 2.5 oocysts:2.2 eggs), then the remaining seasons of the year increases and reaches a maximum in winter (33.3 % with II 5.0 oocysts:30.2 eggs, i.e. strongyloids outnumbered eimeriids by 6 times). In adult animals, the lowest infection rate is observed in winter (3.3 % with an II of 2.0 oocysts:2.0 eggs), then this indicator increases, reaching a maximum in the fall (36.7 % with an II of 3.7 oocysts:4.4 eggs). In winter, the ratio of parasites was equal, in summer, eimeria exceeded strongyloids by 1.6 times, and in spring and autumn it exceeded strongyloids (by 2.4-1.2 times). Thus, in the foothill zone of the Turkestan region, five eimeria species were found in sheep: *Eimeria faurei*, *E. intracata*, *E. ovina*, *E. ovinoidalis*, *E. parva*, and one strongyloid species: *Strongyloides papillosus*.

Discussion of the received data. Eimeria and strongyloids in the body of sheep are found both in the form of mono and in the form of mixed invasions. The infestation of sheep with eimeria, strongyloid and mixed infestations depends on the age. Young animals are more infected with eimeria and eimeria-strongyloid infestations, and vice versa, are less infected with strongyloids than adult animals. The infection rate of sheep with eimeria in the general invasion is 43.1 % with an invasion intensity of 6.8 oocysts, and with monoinvasia 19.7 % with II 7.2 oocysts, i.e. with monoinvasia, EI decreases and the intensity increases. The infection of sheep with a total *Strongyloides* infestation is 37.8% when infection intensity 7.1 eggs, and if monenvasia of 14.2 % at II 6.3 eggs, i.e. monenvasia the extensivity and intensity of infestation is reduced. The infection rate of sheep with mixed eimeria-strongyloid infestation is 23.6 % with an invasion intensity of 6.4 oocysts and 7.6 eggs, i.e., with mixed infestations, strongyloids outnumber eimeria by 1.2 times. With general and separate infection with eimeria and mixed infestations, the highest rates of extensiveness and intensity of invasion in animals were recorded at the age of 1 year, and vice versa, the lowest rates with general and separate infection with strongyloids. With the age of sheep, their infection with eimeria and mixed infestations decreases, and strongyloids, on the contrary, increases. The infestation of sheep with eimeria, strongy-

loids and mixed invasions also depends on the season of the year. The total infection of animals with eimeria in all seasons of the year ranged from 34.4-48.9 %, and II - 3.0-10.6 oocysts. The infection rate of animals with eimeria monoinvasias in autumn and winter was the lowest (14.4 %), then increased in spring and summer (up to 32.2 %), and II also reached a maximum in spring (15.6 oocysts), then gradually decreased reaching a minimum in summer (2.7 oocysts). The total infection of animals with strongyloids in all seasons of the year was on average (20.0-51.1 %), and the II ranged from 3.3-13.3 eggs. The infection rate of sheep with monoinvasia strongyloids was minimal in summer (3.3 %), then it tended to increase: in autumn it reached 16.7 %, in winter – 15.6 %, and in spring - 21.1 %, and the II in all seasons of the year ranged from 3.1-11.8 eggs. The infestation of animals with mixed eimeria-strongyloid infestation in all seasons of the year was below average (16.7-34.4 %), in autumn and winter strongyloids prevailed, and in spring and summer - eimeria. In young animals up to a year, the total infection with eimeria in all seasons of the year was increased (50.0-56.7 %), and the highest II was observed in the spring (18.3 oocysts). In young animals up to two years old, this indicator in all seasons of the year was in the range of 33.3-50.0 %, and the II fluctuated in the range of 2.2-4.3 oocysts. In adult animals, low infestation was observed in winter and spring (16.7 %), and in summer and autumn – high (50.0 %), II ranged from 2.0-3.4 oocysts. In young animals up to a year, the invasion of monoinvasias of eimeria was low in winter (13.3 %) and autumn (20.0 %), in average spring and summer (36.7 %), in animals older than a year, low invasion was observed in spring (13.3-3.3 %), and in summer slightly increased (23.3%). In young animals up to a year, the total infection with strongyloids was the lowest in spring and summer (16.7 % each), the highest in autumn (40.0 %) and winter (46.7 %), and the II ranged from 2.6 – 10.3

eggs. In young animals up to two years old, increased infestation was observed in winter (60.0 %) and autumn (50.0 %), and in the other seasons of the year it ranged from 26.7-33.3 %. In adult animals, increased infestation was found in winter, spring and autumn (63.3 %), and in other seasons of the year it did not exceed 20.0 %, and the II in all seasons ranged from 2.6-4.2 eggs. In young animals up to a year, infection with monoinvasia strongyloids was noted in winter, summer and autumn (3.3 % each), in young animals up to two years old in all seasons of the year: winter (26.7 %), spring (13.3 %), summer (3.3 %) and autumn (20.0 %), and in adults also in all seasons of the year: winter (3.3 %), spring and summer (13.3 % each), autumn (36.7 %). In young animals up to a year, low infection with eimeria-strongyloid invasion was observed in the summer (13.3 %). In the remaining seasons of the year, the EI increased, reaching a maximum in winter (43.3 % with an II of 14.5 oocysts:2.8 eggs). In young animals up to two years old, the infection rate was low in the spring (20.0 %), in the other seasons of the year, reaching a maximum in the winter (33.3 %). The ratio of parasites: in winter, strongyloids were 6 times higher, in summer they were equal, in spring and autumn they were superior to eimeria. In adult animals, the infection rate in winter was the lowest (3.3 %), in spring and summer it was 13.3 %, in autumn – 36.7 %. Eimeria was superior in summer, strongyloids-in spring and autumn, in winter the ratio of parasites was equal.

Conclusion. In the foothill zone of the Turkestan region, five eimeria species were found in sheep: *Eimeria faurei*, *E. intracata*, *E. ovina*, *E. ovinoidalis*, *E. parva*, and one strongyloid species: *Strongyloides papillosus*. These parasites in animals are found in the form of moneywise, and in the form of extenuate. The infestation of sheep with eimeria, strongyloid, and eimeria-strongyloid invasions depends on the age and season of the year.

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