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EIMERIOSES PREVALENT IN SMALL-HORNED ANIMALS IN THE NAKHCHIVAN AUTONOMOUS REPUBLIC

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ЭМИЕРИОЗЫ, РАСПРОСТРАНЕННЫЕ У МЕЛКИХ РОГАТЫХ ЖИВОТНЫХ В НАХЧЫВАНСКОЙ АВТОНОМНОЙ РЕСПУБЛИКЕ

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Abstract. In the article under review, investigations conducted in the Nakhchivan Autonomous Republic focused on the species composition, biological characteristics, and morphological characteristics of *Eimeria* species parasitic in small-horned animals. As a result of the study, it was determined that seven different Eimeria species are parasitic in sheep and six in goats kept in the region. In order to monitor the dynamics of parasite development, observations were made on lambs and goats. The results showed that the excretion of coccidian oocysts in goats is observed on the 20-21 days after birth, and in lambs on the 22-23 days. Accordingly, during these periods, it was found that *Eimeria ninaekohlyakimovae* predominated in sheep, and *Eimeria arloingi* predominated in lambs.

Аннотация. В исследованиях, проведенных в Нахчыванской Автономной Республике, изучен видовой состав эймерий, паразитирующих у мелких рогатых животных, их биологические и морфологические особенности. В результате становлено, что у овец, содержащихся в регионе, паразитируют семь различных видов эймерий, а у коз – шесть. С целью мониторинга динамики развития паразитов проводились наблюдения за ягнятами и козами. Результаты показали, что выделение ооцист кокцидий в организме коз регистрируется на 20-21 день после рождения, а у ягнят – на 22-23 день. У овец преобладала *Eimeria ninaekohlyakimovae*, а у ягнят – *Eimeria arloingi.*

Keywords: sheep, goats, eimeria, livestock diseases, Azerbaijan.

Ключевые слова: овцы, козы, эймерия, заболевания скота, Азербайджан.

Since the Nakhchivan Autonomous Republic has a predominantly mountainous terrain, favorable conditions have been formed for the maintenance and feeding of small ruminants. For this reason, small ruminants predominate in the livestock sector in the region. In the territory of the Autonomous Republic, coccidiosis is widespread among small ruminants, and this disease causes serious economic losses in livestock farms.

Scientific sources contain information about the seasonal periods of coccidiosis and the dynamics of its spread by age groups in the conditions of Nakhchivan. Therefore, it is considered important to conduct research in this direction.

Т. 11. №12 2025
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Research materials and methodology

Research has been conducted in various regions of the Nakhchivan Autonomous Republic since 2024. During the research conducted by the employees of the Institute of Zoology of the Academy of Sciences of the Republic of Azerbaijan in the territory of Nakhchivan, the following 7 Eimeria species were found in sheep: Eimeria ahsata (Honess, 1925), Eimeria bakuensis Musaev, 1970, Eimeria granulosa (Marotel, 1905; Martin, 1909), Eimeria crandallis (Honess, 1942), Eimeria ovis Jaeger, 1921, Eimeria faurei (Moussi et Marotel, 1902), Eimeria intricata (Spiegl, 1925). In goats, 6 Eimeria species have been recorded as parasitic: Eimeria absheronica Musaev, 1970, Eimeria arloingi (Marotel, 1909; Martin, 1909), Eimeria africanensis Musaev et Mamedova, 1981, Eimeria yolchiyevi Musaev, 1970, Eimeria ninakohlyakimovae Jakimoff et Rastegaieff, 1930, Eimeria tunisensis Musaev et Mamedova, 1981 [4, 6, 11, 12].

Oocysts of *Eimeria ovis* (Jaeger, 1921) are 23–26 x 15–24 micrometers in size and have a yellowish-brown color. The sporulation process is completed in about 2–4 days. The schizogony stage of this parasite occurs in the inner epithelial cells of the small intestine, while the gametogony stage is observed in the epithelial tissues of the posterior part of the intestine. The prepatent period lasts a maximum of 19 days.

Oocysts of the species *Eimeria bakuensis* (Musaev, 1970) are 17–25 x 13–20 micrometers in size and have a greenish-gray color. The sporulation period varies between 1–3 days. The schizogony stage occurs in the epithelial cells of the small intestine, and the gametogony stage in the large intestine. The prepatent period varies between 10–15 days.

Oocysts of the species *Eimeria ahsata* (Honess, 1925) are 30–39 x 19–30 micrometers in size, and the sporulation stage lasts up to 2–3 days. Schizogony occurs in the small intestine, and gametogony in the large intestine. The prepatent period of this species is 18–20 days.

Oocysts of *Eimeria faurei* (Moussi et Marotel, 1902) range in size from 13–22 x 11–13 micrometers and are yellowish-brown in color. The sporulation process takes 3–5 days. The schizogony stage of the parasite develops in the small intestine, and the gametogony stage in the large intestine. The prepatent period lasts up to 11–15 days. Since the species *Eimeria intricata* (Spiegi, 1925) and *Eimeria crandalis* (Spiegi, 1925) demonstrate low pathogenicity, there was no need to study their morphometric parameters and development cycle in detail. Oocysts of *Eimeria arloingi* (Marotel, 1909) are 25–33 x 16–21 micrometers in size and are brown in color. The sporulation process lasts 2–4 days. The schizogony stage occurs in the epithelial cells of the small intestine. The prepatent period varies between 14–17 days.

Eimeria ninakohlyakimovae (Jakimoff et Rastegaieff, 1930) is biologically and morphologically similar to *Eimeria ovis*. It is a highly dangerous and pathogenic species, especially for sheep. Mortality in infected animals varies between 80–100%. The size of brown oocysts of *Eimeria absheronica* (Musaev, 1970) is 25–27 × 17–24 micrometers. The sporulation period of this species has not been precisely determined. The prepatent period lasts up to 14–17 days. In general, coccidiosis is considered one of the most widespread protozoan infections among sheep and goats in the world. The species found in the territory of the Nakhchivan Autonomous Republic are listed above, and the prevalence and intensity of infections have also been determined.Discussion and results of the study

In order to investigate the intensity of the spread of eimeriosis among small-horned animals in the Nakhchivan Autonomous Republic, the epizootological situation and seasonal dynamics were studied, as well as to develop preventive and control measures. Expeditions were organized in different parts of the region. During the study, fecal samples of animals on farms were taken and stabilized with a 2.5% potassium dichromate solution. Blood samples were taken from the carotid vein of healthy and sick animals, and their morphological indicators and hemoglobin content were

Т. 11. №12 2025
https://doi.org/10.33619/2414-2948/121

analyzed in laboratory conditions. Additionally, pathological-anatomical changes were observed in the carcasses of dead animals and the seasonal characteristics of the disease were investigated.

According to research on eymeriosis, lambs and goats up to one year old are more susceptible. The body temperature in these animals rises to 40–41°C. Although loss of appetite is observed during the disease, there is an increase in water intake. Diarrhea occurs after a while, and mucus, along with blood, is seen in the feces, accompanied by an unpleasant odor. As the disease progresses, anemia develops.

Studies have shown that in calves, the excretion of coccidia oocysts from the body is usually observed 20–21 days after birth (mainly *Eimeria ninakohlyakimovae*), and in lambs – about 22–23 days after birth (mainly *Eimeria arloingi*). This fact proves that infection in young animals of small ruminants usually occurs from the first days of life, and this is possible as a result of constant contact with their mothers. According to the results of the study, 0.7% of 23-day-old lambs and 18% of calves are already infected with *Eimeria* to varying degrees.

While the infection rate in 3–4-month-old young animals was 18–21%, in 6-month-old animals this indicator ranged from 36.6–87%. In 1.5–2-year-old animals, the intensity of infection was observed between 22–27%, depending on the conditions on the farm, and in some cases, parasite carriage was observed between 13.3–27%. The excretion of *Eimeria* oocysts in old animals reached a maximum level in February-April, that is, during the calving period, which is mainly due to seasonal climatic factors. At the same time, the excretion of oocysts in 5–6-month-old lambs was recorded at its highest level in September-October. Interestingly, the intensity of infection in lambs during that period was relatively low and limited to only a few oocysts. The highest level of *Eimeria* infection in sheep and goats was observed mainly in September-October. During this period, the intensity of infection in lambs was recorded between 70–80%, and in goats - between 79–87%. At the same time, deaths due to the invasion were also detected.

Eimeria ninaekohlyakimovae and *Eimeria arloingi* were most common in goats, and *Eimeria faurei* was more common in lambs. In addition, mixed infections in goats were characterized by the co-parasitism of *E. ninaekohlyakimovae, E. arloingi,* and *E. intricata*, and in lambs – *E. faurei, E. parva*, and E. *intricata*. Studies have shown that under the conditions of the Nakhchivan Autonomous Republic, goats are usually infected with *E. arloingi* when they are 2.5–3 months old. It should also be emphasized that while goats were relatively weakly infected with *E. faurei* and *E. intricata* species in stable conditions (15–23.5%), the level of infection with these species was higher in pasture conditions.

It was determined that the *E. faurei* and *E. intricata* species found in goats from pasture conditions differ morphologically compared to the same species found in stables. The forms found in pastures are larger and covered with thick, multilayered covers. These morphological features allow them to survive longer in the external environment during cold seasons. Also, both their internal (endogenous) and external (exogenous) development stages last longer than those found in stable conditions. The high viability of *Eimeria* species is associated with their intensive reproduction and long-term parasitism in the host organism. During studies conducted in various regions of the Nakhchivan Autonomous Republic, research focused on goats over 2 years old and those aged 2–3.5 months. A total of 475 goats and 450 rams were examined. As a result of the study conducted by Mammadov I. and Abbasova S., cases of coccidial infection in goats were recorded in all regions [2] (Table 1).

According to the data in Table 1, 20 out of 90 goats examined in Sharur district (22.2%) were infected (maximum invasion intensity: 190, average: 23, minimum: 3 oocysts). In Kangarli district, 18 out of 100 goats (18%) were infected (maximum: 180, average: 28, minimum: 1 oocyst). In Babek district, 11 out of 85 goats (12.9%) were infected (maximum: 140, average: 22, minimum: 2

Т. 11. №12 2025
https://doi.org/10.33619/2414-2948/121

oocysts). In Shahbuz district, 9 out of 110 goats (8.2%) were infected (maximum: 120, average: 26, minimum: 1 oocyst). In Julfa district, 11 out of 90 goats examined (12.2%) were infected (maximum: 90, average: 21, minimum: 2 oocysts).

Table 1

INFECTION OF GOATS OVER 2 YEARS OLD WITH COCCIDIA IN THE NAKHCHIVAN AUTONOMOUS REPUBLIC

Regions	*Number of animals studied*	*Infected*	*Infection in %*	*Intensity of invasion*		
				Maximum	*Middle*	*Minimum*
Sharur	90	20	22,2	190	23	3
Kangarli	100	18	18	180	28	1
Babek	85	11	12,9	140	22	2
Shahbuz	110	9	8,2	120	26	1
Julfa	90	11	12,2	90	21	2
Total	475	69	14,5	-	-	-

Mammadov I. and Abbasova S. found that 14.5% of goats older than 2 years in the surveyed farms were infected with coccidia [2].

Infection rates varied from 8.2% to 75% in some farms. However, in general, coccidiosis was not recorded at a significant level in older goats. Oocyst excretion was, in most cases, moderate, with a maximum of 90–190 and a minimum of 1–3 oocysts. On the other hand, the infection status of 4–4.5-month-old goats with coccidia revealed a different picture. A high level of infection in young animals was detected in all farms studied. The infection percentage of goats on different farms varied from 6.6% to 78% (Table 2).

Table 2

INFECTION OF 4–4.5-MONTH-OLD GOATS WITH COCCIDIA IN THE CONDITIONS OF NAKHCHIVAN AUTONOMOUS REPUBLIC

Regions	*Number of animals studied*	*Infected*	*Infection in %*	*Intensity of invasion*		
				Maximum	*Middle*	*Minimum*
Sharur	100	78	78	2100	380	11
Kangarli	120	80	66,6	320	95	4
Babek	80	60	75,5	180	85	3
Shahbuz	100	71	71	170	65	3
Julfa	110	65	59,9	160	50	2
Total	510	354	69,4	-	-	-

As a result of examinations conducted in farms in the Sharur region, coccidia oocysts were found in 78 out of 100 calf samples, and the maximum infection extensiveness was recorded as 78% (II: highest — 2100, average — 380, lowest — 11 oocysts/unit). In the Kangarli region, 80 out of 120 calf samples examined gave positive results, and the extensiveness of the invasion was 66.6% (II: maximum — 320, average — 95, minimum — 4 oocysts/unit). In the Babek region, analysis of samples taken from 80 herds showed that 60 animals were infected with coccidia, which indicates an extensiveness of 75.5% (II: maximum — 180, average — 85, minimum — 3 oocysts/unit).

In Shahbuz district, 71 out of 100 samples were considered infected and the overall infection rate was recorded as 71% (CI: maximum – 170, average – 65, minimum – 3 oocysts/unit). In Julfa

Т. 11. №12 2025
https://doi.org/10.33619/2414-2948/121

district, 65 cases of infection were identified among 110 calf samples and the extensiveness of invasion was determined as 59.9% (CI: maximum – 160, average – 50, minimum – 2 oocysts/unit).

However, general analyses showed that the extensiveness of infection in the flocks in the studied farms was relatively higher. The same trend was observed in the intensity of invasion. Thus, the maximum CI varied between 160–2100, the average CI varied between 50–380, and the minimum CI varied between 2–11 oocysts/unit.

This fact indicates that the average intensity of eimeriosis invasion in young animals is approximately 3–10 times higher than in older goats. In accordance with the literature, this situation is explained by the decrease in the level of invasion in adults due to repeated infections and the formation of immunity with increasing age.

Based on the results obtained from the tables mentioned by Mammadov I. and Abbasova S. above, it can be said that the incidence of coccidia infection among both goats and sheep in the farms of the Sharur region is high [2]. This is due to the quality of the conditions in which the animals are kept, the development period of coccidia spores in pasture areas, and the existing climatic factors.

The level of coccidia contamination of pastures and lands belonging to farms located in the territory of the Nakhchivan Autonomous Republic is summarized in the table below (Table 3).

Table 3

CONTAMINATION OF PASTURES AND FARM LANDS WITH COCCIDIAN

Regions	*Number of studied samples*	*Number of oocysts detected*	*Also sporulating oocysts*	*Number of sporulated oocysts per sample*
Sharur	180	2090	1200	8,3
Babek	105	405	211	2
Julfa	110	511	301	2,8
Shahbuz	80	195	102	1,8

The above analysis shows that the contamination levels of coccidia oocysts in soil samples from pastures in different regions vary. As a result of the analysis conducted in the Sharur region, it was determined that there were an average of 8.3 oocysts per sample in soil and substrate samples, which is higher than in other regions. In the Babek region, a total of 405 oocysts were detected in 105 soil samples, 211 of which were sporulated, resulting in an average of 3.9 oocysts per sample.

A total of 511 coccidia oocysts were found in 110 soil samples taken from the Julfa region, of which 301 were in the sporulation stage. The average was 4.6 oocysts per sample. During the analysis conducted in the Shahbuz region, 195 oocysts were detected in 80 samples, 102 of which were sporulated, with an average of 2.4 oocysts/sample.

A large number of degenerative oocysts (i.e., darkened and membrane-disintegrated) were found in the studied samples. At the same time, sporocysts emerging from oocysts were also observed under the microscope. It was determined that *Eimeria* is more widespread in the Nakhchivan Autonomous Republic during the summer months (March, April, and May). During this period, temperature and humidity create favorable conditions for the development of *Eimeria*. In addition, the weakening of the immune system of animals that have just completed the winter season and insufficient nutrition also contribute to the spread of infection.

In the summer months, the increase in air temperature in the region to 40–45°C significantly slows down the development process of *Eimeria*. For this reason, growth retardation occurs in lambs and goats recovering from the disease, which results in serious economic losses for farmers engaged in livestock breeding.Signs of jaundice and anemia are observed in young animals that have died from eimeria. Hemorrhagic inflammation, wall thickening and necrosis are also detected

in the intestines. The tail and hind limbs are contaminated with liquid feces. Numerous bleeding foci and ulcers are visible in the wall of the small intestine. During microscopic analysis, the presence of various stages of Eimeria in the infected areas is considered a significant indicator for diagnosis.

Conclusions

As a result of the conducted studies, it was determined that the most common coccidia species in goats in the Nakhchivan Autonomous Republic were *E. ninakohlyakimovae* (30.4%), *E. yolchiyevi* (22.8%), *E. absheronica* (18.4%), and *E. africiensis* (15.2%). The most rare cases were recorded for *E. arlongi* (1.8%) and *E. tunisensis* (1.8%).

During the study, it was determined that *E. granulosa* (2.3) and *E. ahsata* (1.7) species showed high intensity in sheep. The lowest indicators were recorded in *E. faurei* (1.3) and *E. intricata* (1.1). In goats, the highest intensity of invasion was observed in *E. ninakohlyakimovae* (2.2) and *E. yolchiyevi* (2.1), while the lowest intensity was observed in *E. absheronica* (1.1), *E. africiensis* (1.3), and *E. tunisensis* (1.3).

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