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Research Article

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The Influence of Environmental Factors on the İnvasion of Domestic Chickens with Species of the Genus Eimeria in the Territory of Sharur District (Nakhchivan Autonomous Republic)

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Abstract

The aim of this study was to study the epizootological status of Eimeria species distributed in domestic chickens in the Sharur district of the Nakhchivan Autonomous Republic and to identify the main ecological factors affecting their spread. During the study, fecal samples were collected from various private farms and examined in the laboratory using the flotation method. As a result of the examinations, the following species were detected: E. tenella (38.2%), E. maxima (41.1%), E. acervulina (36.7%), E. necatrix, (32.3%), E. mitis (25.7%), E. praecox (21.3%) and E. brunetti (18.3%). It was determined that the level of invasion is closely related to seasonal changes and zones. The results obtained are of scientific and practical importance in terms of the development of poultry farming in the region and the improvement of measures to combat Eimeria.

Keywords: Eimeria, İnvasion, Extensiveness, İntensity, Domestic Chickens

1. Introduction

The territory of Sharur district is one of the areas where poultry farming is widespread in the Nakhchivan Autonomous Republic. Here, chickens are mainly kept in private subsidiary and family farms, in open and semi-open conditions. Such conditions of keeping create favorable conditions for the spread of some invasive diseases, especially species belonging to the genus Eimeria. Coccidiosis disease caused by species belonging to the genus Eimeria causes serious pathological changes in chickens, reduced productivity and economic losses. Seasonal factors, climatic conditions and the farm environment directly affect the spread of the invasion. Since the Sharur region encompasses plain and foothill zones in terms of climate, studying the seasonal distribution dynamics of species belonging to the genus Eimeria here is of topical and practical importance.

The extensiveness of Eimeria species was high in the foothills and low in the plains. The highest extent of invasion was recorded in spring and autumn, and the lowest in winter. Based on examinations conducted on fecal samples of chickens in these areas according to the seasons of the year, the intensity of the spread of invasions by season was clarified. The extensiveness and intensity of *E. tenella, E. necatrix, E. maxima, E. mitis, E. acervulina, E. praecox, E. brunetti* species infected in chickens kept in areas with different natural climates of the region were high in the foothills and low in the plains. The maximum intensity of invasion in chickens occurs in spring and autumn in both climatic zones, and the minimum falls in winter.

2. Material and Methods

2.1. Sample Collection

The study was conducted at the Institute of Bioresources of Nakhchivan State University. For this study, the following areas were selected for the Plain area in Sharur district: Pusyan (N 39°27′06.16″ E 45°02′10.10″), Khanliglar (N 39°30′12.96″ E 45°01′35.58″), Sharur district center (N 39°33′25.71″ E 44°59′18.68″), Alishar village (N 39°32′12.74″ E 44°55′33.87″), Siyagut (N 39°32′25.88″ E 45°01′18.30″), Jalilkend (N

39°34′23.02″ E 45°00′38.57″), Yayci (N 39°37′16.15″ E) 45°04′54.09″) farms located in villages. In the foothill area: farms in the villages of Shahbulag (N 39°38′57.24″ E 45°09′11.35″) and Akhura (N 39°33′47.05″ E 45°09′54.96″) were selected. A total of 484 fecal samples were collected, of which 348 samples were taken from plain areas and 136 samples from foothill areas. The number of chickens in the farms we sampled ranged from 4 to 45. Fecal samples were collected only once from backyard chickens. 1 or 2 samples were collected manually by random sampling from each house. Each fecal sample was collected from the floor immediately after defecation. Then, 2% potassium bichromate ($K_2Cr_2O_7$) solution was added to the samples and mixed for 2-3 days to sporulate the oocysts. Flotation method. Flotation method was used to detect oocysts. For this purpose, fecal samples were centrifuged in a saturated NaCl solution at 1500 rpm for 2 minutes [1]. Then, a drop was taken from the upper surface of the liquid using a circular copper hook, placed on a glass slide and covered with a coverslip. The samples were examined under a microscope (Nicon Eclipse Ci Japan, SMART 3 T2/L) under x10, x20, x40 objectives. Identification of oocysts detected during the examination was carried out based on relevant literature sources [2].

Seasonal distribution dynamics of Eimeria species in domestic chickens in the Sharur region

Seasons of the year	Number of fecal samples examined	Species belonging to the genus Eimeria																				
		E. tenella			*E. maxima*			*E. acervulina*			*E. necatrix*			*E. mitis*			*E. praecox*			*E. brunetti*		
		Number of infected samples	Extensiveness of invasion(%)	İntensity of invasion*	Number of infected samples	Extensiveness of invasion(%)	İntensity of invasion*	Number of infected samples	Extensiveness of invasion(%)	İntensity of invasion*	Number of infected samples	Extensiveness of invasion(%)	İntensity of invasion*	Number of infected samples	Extensiveness of invasion(%)	İntensity of invasion*	Number of infected samples	Extensiveness of invasion(%)	İntensity of invasion*	Number of infected samples	Extensiveness of invasion(%)	İntensity of invasion*
Plain zone																						
Spring	96	42	43,7	1-30	39	40,6	1-23	40	41,6	1-22	33	34,3	1-19	28	29,1	1-16	25	26,0	1-10	14	14,5	1-5
Summer	84	26	30,9	1-20	23	27,3	1-14	21	25,0	1-15	18	21,4	1-13	17	20,2	1-9	14	16,6	1-6	9	10,7	1-3
Autumn	90	35	38,8	1-27	40	44,4	1-32	34	37,7	1-19	32	35,5	1-20	25	27,7	1-14	18	20,0	1-9	17	18,8	1-5
Winter	78	18	23,0	1-13	16	20,5	1-9	15	19,2	1-8	14	17,9	1-8	12	15,3	1-6	7	8,9	1-3	5	6,4	1-1
Total	348	121	34,7	1-30	118	33,9	1-32	110	31,6	1-22	97	27,8	1-20	82	23,5	1-16	64	18,3	1-10	45	12,9	1-5
Foothills zone																						
Spring	41	19	46,3	1-37	17	41,4	1-37	18	43,9	1-40	15	36,5	1-17	13	31,7	1-21	11	26,8	1-9	8	19,5	1-4
Summer	38	13	34,2	1-20	14	36,8	1-24	12	31,5	1-21	9	23,6	1-10	9	23,6	1-8	7	18,4	1-4	5	13,1	1-1
Autumn	32	13	40,6	1-31	16	50,0	1-48	14	43,7	1-32	13	40,6	1-24	8	25,0	1-14	7	21,8	1-6	8	25,0	1-5
Winter	25	7	28,0	1-12	9	36,0	1-15	6	24,0	1-14	8	28,0	1-12	5	20,0	1-5	4	16,0	1-2	4	16,0	1-3
Total	136	52	38,2	1-37	56	41,1	1-48	50	36,7	1-40	44	32,3	1-24	35	25,7	1-21	29	21,3	1-9	25	18,3	1-5

Table 1

* the number of oocysts in one field of view of the microscope

As can be seen from the table, a total of 348 fecal samples were collected from the plain zone throughout the year, and 136 from the foothill zone. 96 samples were collected from the plain zone in the spring. *E. tenella* species (IE- 43.7%) was found in 42 of these samples, with an ID ranging from 1-30. *E. maxima* species was found in 39 of the 96 samples (IE- 40.6%; ID: 1-23), *E. acervulina* species was found in 40 samples (IE- 41.6%; ID: 1-22). *E. necatrix* species was found in 33 samples (IE- 34.3%; ID: 1-19). Of the other species, *E. mitis* was detected in 28 samples (IE- 29.1%; CI: 1-16), *E. praecox* in 25 samples (IE- 26.0%; CI: 1-10), and *E. brunetti* in 14 samples (IE- 14.5%; CI: 1-5). A total of 84 samples were collected during the summer season, of which 26 contained *E. tenella* (IE- 30.9%; CI: 1-20), 23 *E. maxima* (IE- 27.3%; CI: 1-14), 21 *E. acervulina* (IE- 25.0%; CI: 1-15), 18 E. necatrix (IE- 21.4%; CI: 1-13), 17 *E. mitis* (IE- 20.2%; CI: 1-9), 14 *E. praecox* (IE- 16.6%; CI: 1-6), and 9 *E. brunetti* (IE- 10.7%; CI: 1-3) species.

In the fall, 90 samples were collected, of which 35 contained E. tenella (IE- 38.8%; CI: 1-27), 40 contained *E. maxima* (IE- 44.4%; CI: 1-32), 34 contained E. acervulina (IE- 37.7%; CI: 1-19), 32 contained *E. necatrix* (IE- 35.5%; CI: 1-20), 25 contained *E. mitis* (IE- 27.7%; CI: 1-14), 18 contained *E. praecox* (IE- 20.0%; CI: 1-9), and 17 contained *E. brunetti* (IE- 18.8%; CI: 1-5).

A total of 78 samples were collected in the winter season of the plain zone, of which *E. tenella* (IE- 23.0%; CI: 1-13) was recorded in 18 samples, *E. maxima* (IE- 20.5%; CI: 1-9) in 16 samples, *E. acervulina* (IE- 19.2%; CI: 1-8) in 15 samples, *E. necatrix* (IE- 17.9%; CI: 1-8) in 14 samples, *E. mitis* (IE- 15.3%; CI: 1-6) in 7 samples, *E. praecox* (IE- 8.9%; CI: 1-3) in 5 samples, and *E. brunetti* (IE- 6.4%; CI: 1-1) in 5 samples. In total, of the 348 fecal samples collected from the plain zone, *E. tenella* (IE- 34.7%; CI: 1-30) was found in 121, *E. maxima* (IE- 33.9%; CI: 1-32) in 118, E. acervulina (IE- 31.6%; CI: 1-22) in 110, *E. necatrix* (IE- 27.8%; CI: 1-20) in 97, *E. mitis* (IE- 23.5%; CI: 1-16) in 64, *E. praecox* (IE- 18.3%; CI: 1-10) in 45, *E. brunetti* (IE- 12.9%; CI: 1-5) in 100.

The study found that Eimeria species were widely distributed among domestic chickens in the plain zone of Sharur region. In general, oocysts of various species of Eimeria were found in the majority of 348 fecal samples collected from the plain zone. The highest prevalence was recorded in the *E. tenella* species (IE- 34.7%), followed by *E. maxima* (IE- 33.9%) and *E. acervulina* (IE- 31.6%). These species also differed in terms of the intensity of invasion, with the E. maxima species varying from 1 to 32.

When looking at the seasonal dynamics, it was observed that the prevalence of species belonging to the genus Eimeria was higher in spring and autumn, and showed a decreasing trend in summer and especially winter. Thus, in spring, the IE- of *E. maxima*, *E. acervulina* and *E. tenella* species was above 40%, and these indicators decreased significantly in summer. In autumn, an increase was observed again, and in winter, both extensiveness and intensity indicators for all species decreased to a minimum level. As can be seen from the table, a total of 136 fecal samples were collected from the foothill zone of the region across all seasons. A total of 41 samples were collected in the spring season, of which 19 samples contained *E. tenella* (IE-46.3%; CI: 1-37), 17 samples contained *E. maxima* (IE-41.4%; CI: 1-37), 18 samples contained *E. acervulina* (IE-43.9%; CI: 1-40), 15 samples contained E. necatrix (IE-36.5%; CI: 1-17), 13 samples contained *E. mitis* (IE-31.7%; CI: 1-21), 11 samples contained *E. praecox* (IE-26.8%; CI: 1-9), and 8 samples contained *E. brunetti* (IE-19.5%; CI: 1-4). A total of 38 samples were collected in the summer, of which 13 samples contained *E. tenella* (IE-34.2%; CI: 1-20), 14 samples contained *E. maxima* (IE-36.8%; CI: 1-24), 12 samples contained E. acervulina (IE-31.5%; CI: 1-21), 9 samples contained *E. necatrix* (IE-23.6%; CI: 1-10), 9 samples contained *E. mitis* (IE-23.6%; CI: 1-8), 7 samples contained *E. praecox* (IE-18.4%; CI: 1-4), and 5 samples contained *E. brunetti* (IE-13.1%; CI: 1-1).

A total of 32 samples were collected in autumn, of which 13 samples contained *E. tenella* (IE-40.6%; CI: 1-31), 16 samples contained *E. maxima* (IE-50.0%; CI: 1-48), 14 samples contained *E. acervulina* (IE-43.7%; CI: 1-32), 13 samples contained *E. necatrix* (IE-40.6%; CI: 1-24), 8 samples contained *E. mitis* (IE-25.0%; CI: 1-14), 7 samples contained E. praecox (IE-21.8%; CI: 1-6), and 8 samples contained *E. brunetti* (IE-25.0%; CI: 1-5). A total of 25 fecal samples were collected in winter, of which *E. tenella* (IE-28.0%; CI: 1-12) was recorded in 7 samples, *E. maxima* (IE-36.0%; CI: 1-15) in 9 samples, *E. acervulina* (IE-24.0%; CI: 1-14) in 6 samples, *E. necatrix* (IE-28.0%; CI: 1-12) in 8 samples, *E. mitis* (IE-20.0%; CI: 1-5) in 4 samples, E. praecox (IE-16.0%; CI: 1-2) in 4 samples, and *E. brunetti* (IE-16.0%; CI: 1-3) in 4 samples. In total, 136 fecal samples were collected in all seasons for the foothill zone, of which 52 contained *E. tenella* (IE-38.2%; CI: 1-37), 56 contained *E. maxima* (IE-41.1%; CI: 1-48), 50 contained *E. acervulina* (IE-36.7%; CI: 1-40), 44 contained *E. necatrix* (IE-32.3%; CI: 1-24), 35 contained *E. mitis* (IE-25.7%; CI: 1-21), 29 contained *E. praecox* (IE-21.3%; CI: 1-9), and 25 contained *E. brunetti* (IE-18.3%; CI: 1-5).

Various species of the genus Eimeria were found during microscopic examination of 136 fecal samples collected from the foothills of the Sharur region. The highest prevalence rates were observed in *E. maxima* (IE-49.2%) and *E. tenella* (46.3%). Analysis by seasons showed that parasitic infections were higher in spring and autumn. Especially in spring, *E. maxima* increased to IE-41.1% and IE up to 48. At the same time, E. acervulina and E. tenella were also observed with high intensity in this season (IE: 40 and 37). In summer and winter, both extensiveness and intensity indicators decreased for all species.

3. Results

The results show that the prevalence of Eimeria species in the foothill zone varies depending on the season and the biological characteristics of the parasite species. The predominance of spring in parasitological indicators is probably due to the favorable temperature and humidity factors for the development of oocysts. As a result of the conducted studies, it was determined that the prevalence of Eimeria species among domestic chickens in both the plain and foothill zones of the Sharur region was widespread. However, some differences were observed between the zones in terms of infection rates and species composition. The dominant species in both zones were E. maxima, E. tenella and E. acervulina. However, in the foothill zone, both the extensiveness (IE) and intensity (II) indices of these species were higher than in the plain zone. For example, the maximum II of E. maxima in the foothill zone reached 48, while in the plain this index was 32. The same situation was observed for E. acervulina (II: 40 and 22) and E. tenella (II: 37 and 30). This can be explained by the fact that the microclimatic conditions in the foothill zone (relatively mild temperature and humidity) are more favorable for the development of oocysts. Similar results have been noted by a number of modern researchers [3-6]. In terms of seasonal distribution, spring and autumn seasons were characterized by the highest infection levels in both zones. In general, the obtained results show that the prevalence of Eimeria invasions, while differing by zone, is closely related to climatic and environmental factors, chicken housing conditions and sanitary hygiene. More favorable climatic factors in the foothill zones led to a longer and more intensive development of Eimeria invasions here.

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