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Translated from Russian by Virginia Ivens. Svanbaev, S. K. 1958. The coccidial fauna of wild ungulates of Kazakhstan. Works of the Institute of Zoology Academy of Sciences, Kazakh SSR 9: 187-197. Transliteration: Fauna koktsidi! dikikh kopyteykh zhivoteykh Kazakhstana. Trudy Instituta Zoologii Akademii Nauk Kazakh SSR 9: 187-197

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COLLEGE OF VETERINARY MEDICINE
UNIVERSITY OF ILLINOIS
URBANA, ILLINOIS

TRANSLATION NO. 9

Translated from Russian by Virginia Ivens

Svanbaev, S. K.

1958. The coccidial fauna of wild ungulates of Kazakhstan. Works of the Institute of Zoology Acad. Sci. Kazakh SSR 9:187-197.

Transliteration:

Fauna koktsidiĭ dikikh kopytnykh zhivotnykh Kazakhstana.
Trudy Instituta Zoologii Akad. Nauk Kazakh SSR 9:187-197.

The coccidia of wild ungulates from Kazakhstan had not been studied before 1956 when we (Svanbaev, 1956) discovered Eimeria elegans in the antelope in the West Kazakhstan region.

The specific morphology of the coccidia of wild ungulates needs to be known. First, since these animals are often found on the same pastures with domestic animals, or are found in areas where livestock had once been raised, cross-transmission of coccidia could occur. Secondly, it should be known whether these coccidia are pathogenic for such valuable wild game. Finally, they are of interest from a general biological viewpoint (zoo-geographical, phylogenetic, etc.).

From 1953 to 1956 we examined 203 wild ungulates for coccidia. The animals belonged to six species and were obtained from five different regions of Kazakhstan. We examined antelopes from the West-Kazakh region; antelopes, gazelles, and argalis from the desert of Betpak-Dala; gazelles from Muyun-Kum; and argalis, [Siberian] goats, roe deer, and wild boars from Talasskiĭ Alatau and Zailiĭskiĭ Alatau. Intestinal contents were collected from dissected animals and put in 2% potassium dichromate at a temperature of 25° to 28° to allow the coccidian oocysts to sporulate. The investigation was carried out according to the method of Darling.

I want to express my gratitude to A. A. Sludskiĭ, M. I. Ismagilov, A. Kh. Khusainov, L. I. Lavrov, and Ya. N. Zakhryalov for supplying the intestinal contents from the wild ungulates.

The descriptions of the coccidian oocysts found are presented according to the host animal.

Wild Boar - Sus scrofa

We examined five wild boars from Zailiĭskiĭ Alatau and Talasskiĭ Alatau. In two animals we found oocysts of two species of coccidia, Eimeria scabra and E. debliecki. These species are common in domestic swine, but this is the first time they have been reported from wild boars.

Eimeria scabra Henry, 1931

This species was found in one animal only. The oocysts are oval and short-oval, and yellow-green, yellow-brown or brown. They measure 24.1 to 31.2 by 19.6 to 26.3 microns with a mean of 26.3 by 21.8 microns. The form-index is 1:0.81 to 0.84 with a mean of 1:0.83. The oocyst wall is smooth, double-contoured, 1.2 to 1.7 microns thick. The protoplasm completely fills the fresh oocyst. A polar granule is usually present at one end of the oocyst. In the sporulated oocyst there are four elongate-oval or oval sporocysts, 7.4 to 15.3 by 5.1 to 7.0 microns with a mean of 10.4 by 6.0 microns. Each sporocyst contains two spherical sporozoites, 5.1 microns in diameter, and a residuum in the form of fine granules.

The sporulation time is seven to eight days.

Eimeria deblicieki Douwes, 1921

This species was found also in only one wild boar. The oocysts are oval, 26.4 to 33.2 by 20.8 to 27.6 microns with a mean of 30.2 by 24.1 microns. The form-index is 1:0.79 to 0.83 with a mean of 1:0.80. The oocyst wall is double contoured, yellow-green, yellow-brown, or brown, rough, 1.5 to 2.1 microns thick, becoming somewhat thinner at the poles. The protoplasm usually fills the fresh oocyst completely. Two polar granules are generally present between the protoplasmic mass and the oocyst wall. In the sporulated oocyst there are four oval sporocysts, 13.5 to 15.9 by 5.8 to 7.7 microns with a mean of 14.7 by 6.8 microns. Each sporocyst contains two spherical sporozoites, 5.3 microns in diameter, and a residuum in the form of a fine-grained mass.

The sporulation time is five to seven days.

Roe Deer - Capreolus capreolus

Three roe deer (one four months of age and two 18 months) from Talasskiĭ Alatau were examined and found infected with a coccidium of the genus Isospora. Apparently this species is quite specific for the roe deer because it was not found in the other ungulates.

Isospora capreoli n. sp.

The oocysts (Figs. 1a, 1b, 1v) are egg-shaped or pear-shaped, 40.0 to 46.0 by 28.1 to 32.4 microns with a mean of 30.8 by 43.3 microns. The form-index is 1:0.71. The wall is smooth, double-contoured, 2.0 to 4.0 microns thick. It is yellow-brown or brown and radially striated on the inner side. A prominent micropyle, 3.8 to 4.7 microns wide, is present at the narrow end of the oocyst. Occasionally an inconspicuous micropylar cap is present. In fresh oocysts the protoplasm is frequently spherical and rarely fills the entire oocyst. A polar granule is absent.

On the second or third day of sporulation two pear-shaped, egg-shaped, or oval sporocysts, and a short oval oocyst residuum, 8.8 by 8.0 microns, are formed. The sporocysts measure 10.7 to 15.8 by 18.9 to 24.5 microns with a mean of 13.5 by 21.7 microns. At the end of sporulation each sporocyst contains four pear-shaped or comma-shaped sporozoites, 3.2 to 4.2 by 8.3 to 13.0 microns with

a mean of 3.9 by 11.0 microns. The majority of the oocysts sporulated in three to four days.

Of those coccidia already described from deer, our species most closely resembles I. rangiferis Jakimoff, Spartanskaja and Matschoulsky, 1936 (Table 1). The oocysts of our species differ from the oocysts of I. rangiferis in lacking a polar granule, in having a micropyle, in being larger, in having an oocyst residuum, and in lacking a sporocyst residuum.

Gazelle - Gazella subgutturosa

Seventeen gazelles (three 12 months of age and 14 more than a year old) from the deserts of Betpak-Dala and Muyun-Kum were examined, and oocysts were found in eight. The coccidia belonged to two species, E. elegans and E. ninae kohl-jakimov. This is the first time the latter species, which is found in sheep and goats, has been reported from gazelles. The first species is found in antelopes as well as in gazelles.

Eimeria elegans Jakimoff, Gousseff and Rastegaieff, 1932

This species was found in two gazelles (11.8%). The oocysts are ellipsoidal, 31.6 to 38.7 by 15.8 to 25.4 microns with a mean of 35.1 by 21.7 microns. The form-index is 1:0.50 to 0.66 with a mean of 1:0.62. The oocyst wall is smooth, double contoured, yellow-green or yellow-brown, 1.1 to 1.8 microns thick. A prominent micropyle is present at the narrow end of the oocyst. A polar granule is sometimes present. The protoplasm completely fills the freshly passed oocyst.

In the sporulated oocyst there are four oval, short-oval, or spherical sporocysts, 8.8 to 12.8 by 7.2 to 11.5 microns with a mean of 10.7 by 8.8 microns. In each there are two bean-shaped, comma-shaped, or pear-shaped sporozoites, 3.6 to 5.5 by 6.1 to 9.4 microns with a mean of 4.5 by 8.0 microns. A sporocyst residuum, in the form of fine granules, is present.

The sporulation time is three to five days.

Eimeria ninae kohl-jakimov Jakimoff and Rastegaieff, 1930

This species was found in seven (41.2%) of the gazelles examined. The oocysts are oval, short-oval or spherical, 16.6 to 24.9 by 19.7 to 28.0 microns with a mean of 19.8 by 24.2 microns. The form-index is 1:0.84 to 0.87 with a mean of 1:0.82. The wall is smooth, double contoured, greenish, yellow-green, or brown, 1.2 to 1.7 microns thick. A micropyle is absent. In the sporulated oocyst there are four oval or short-oval sporocysts, 5.1 to 7.8 by 6.5 to 11.3 microns with a mean of 6.4 by 8.7 microns. The sporozoites are comma-shaped, 2.3 to 3.7 by 3.8 to 7.6 microns with a mean of 2.9 by 5.8 microns. A residual body is found only in the sporocyst.

The sporulation time is two to three days.

Argali - Ovis ammon

Seven adult argalis (three from Talasskiĭ Alatau and four from the desert of Betpak-Dala) were examined, and five of them were found to be infected with coccidia. The coccidia belonged to three species: E. faurei,

E. ninae kohl-jakimov, and E. intricata. This is the first time the latter species has been reported from O. ammon, and the first that the two former species have been reported from O. ammon in Kazakhstan. All three of these species parasitize domestic sheep and goats.

Eimeria faurei Moussu and Marotel, 1905

This species was found in two O. ammon (28.6%). The oocysts are oval or short-oval, 18.7 to 24.1 by 20.1 to 29.2 microns with a mean of 20.6 by 25.1 microns. The form-index is 1:0.83 to 0.93 with a mean of 1:0.82. The wall is smooth, double-contoured, yellow-green, orange-brown, or brown, and 1.2 to 1.6 microns thick. A micropyle is present at the narrow end of the oocyst. A cap, 2.0 to 4.0 microns high and 4.4 to 7.9 microns wide, is sometimes present. The sporocysts are oval or short-oval, 4.7 to 8.7 by 5.5 to 11.9 microns with a mean of 6.1 by 8.2 microns. The sporozoites are comma-shaped or pear-shaped, 2.3 to 4.4 by 4.9 to 7.6 microns with a mean of 3.0 by 6.1 microns. A sporocyst residuum is present.

The sporulation time is two to three days.

Eimeria ninae kohl-yakimov Jakimoff and Rastegaleff, 1930

This species was found in three O. ammon (42.9%). The oocysts are oval, short-oval, or spherical, 18.4 to 27.2 by 19.5 to 27.6 microns with a mean of 21.9 by 25.1 microns. The form-index is 1:0.94 to 0.99 with a mean of 1:0.87 [?]. The wall is smooth, double-contoured, greenish, yellow-green, or yellow-brown, 1.1 to 2.3 microns thick. The sporocysts are oval or spherical, 6.0 to 7.5 by 8.2 to 11.7 microns with a mean of 6.8 by 10.0 microns. The sporozoites are comma-shaped, 2.8 to 3.5 by 5.2 to 8.1 microns with a mean of 3.1 by 6.6 microns. A sporocyst residuum is present in the form of a granular mass.

The majority of the oocysts sporulated in two to three days.

Eimeria intricata Spiegel, 1925

This species was found in two O. ammon (28.6%). The oocysts of this coccidium are the largest of all the species found in the argali. They measure 33.6 to 40.7 by 39.5 to 51.4 microns with a mean of 37.9 by 46.2 microns. The form-index is 1:0.79 to 0.85 with a mean of 1:0.82. The oocysts are oval or short-oval and yellow-brown or brown. The wall is tri-contoured, 3.5 to 4.3 microns thick. The outer layer is rough and the inner layer has radial striations. There is a micropyle with a cap at the narrow end of the oocyst. The cap is 6.0 to 15.8 microns wide at the base and 3.1 to 5.4 microns high. The sporocysts are pear-shaped, egg-shaped or oval, 8.5 to 13.1 by 11.7 to 19.7 microns with a mean of 10.5 by 14.7 microns. The sporozoites are 4.1 to 5.7 by 7.9 to 12.7 microns with a mean of 4.5 to 10.6 microns. A sporocyst residuum is present.

The sporulation time is five to six days.

[Siberian] Goat - Capra sibirica

Coccidia were found in eight goats (five adults: two 18 months of age and one six months) from Talasskiĭ Alatau. The coccidia belonged to three species: E. faurei, E. ninae kohl-jakimov, and E. parva. This is the first time these species, which are commonly found in domestic sheep and goats, have been reported from [Siberian] goats.

Eimeria faurei Moussu and Marotel, 1905

This species was found in seven (87.5%) of the eight goats examined. The oocysts are short-oval, oval, or elongate-oval, 19.9 to 26.4 by 23.0 to 31.6 microns with a mean 21.7 by 27.2 microns. The form-index is 1:0.84 to 0.87 with a mean of 1:0.80. The wall is smooth, double-contoured, 1.2 to 1.7 microns thick, yellowish, yellow-green, yellow-brown, or orange-brown. A micropyle is present. A micropylar cap, 3.7 to 5.8 microns wide at the base and 2.4 to 3.9 microns high, is usually present. The protoplasmic mass in the fresh oocyst is usually spherical.

The sporocysts are spherical, short-oval, or oval, 6.6 to 8.6 by 7.8 to 12.5 microns with a mean of 7.7 by 9.7 microns. The sporozoites are comma-shaped or pear-shaped, 1.8 to 3.6 by 3.5 to 7.1 microns with a mean of 2.4 by 5.2 microns. An oocyst residuum is absent; a sporocyst residuum is present in the form of a granular mass.

The majority of the oocysts sporulate in two to three days.

Eimeria ninae kohl-jakimov Jakimoff and Rastegaieff, 1930

This species was found in seven (87.5%) of eight goats examined. The oocysts are oval, short-oval or spherical, 19.5 to 24.1 by 20.7 to 25.4 microns with a mean of 20.7 by 23.4 microns. The form-index is 1:0.94 to 0.95 with a mean of 1:0.88 [?]. The wall is smooth, double-contoured, yellow-green, yellow-brown, or orange-brown, 1.2 to 1.6 microns thick. Micropyle and cap are absent. The protoplasmic mass is spherical.

The sporocysts are spherical, short-oval, or oval, 6.2 to 8.2 by 7.0 to 11.7 microns with a mean of 7.3 [by] 9.7 microns. The sporozoites are comma-shaped, 1.8 to 4.2 by 3.3 to 6.5 microns with a mean of 3.1 by 5.4 microns. An oocyst residuum is absent, but a sporocyst residuum is present.

The majority of the oocysts sporulate in two days.

Eimeria parva Kotlan, Mocsy and Vajda, 1929

This species was found in only one animal (12.5%). It is the smallest of all the species found in the [Siberian] goats. The oocysts are short-oval or spherical, 12.0 to 16.4 by 12.4 to 16.4 microns with a mean of 13.7 by 14.5 microns. The form-index is 1:0.94. The wall is delicate, smooth, double-contoured, colorless, and 1.0 micron thick. The sporocysts are oval, short-oval or spherical, 3.2 to 4.0 by 3.9 to 5.0 microns with a mean of 3.6 by 4.5 microns. The sporozoites are comma-shaped, 1.6 to 2.0 by 2.5 to 3.8 microns, with a mean of 1.8 by 3.2 microns. A sporocyst residuum is present; an oocyst residuum is absent.

The sporulation time is four days.

[Saiga] Antelope - Saiga tatarica

We examined 163 [Saiga] antelopes (123 more than a year old and 40 up to 13 months of age). They were obtained from Western Kazakhstan region and the desert of Betpak-Dala. Coccidia were found in 65 animals (39.9%). The majority of the young animals infected were from one to one-and-a-half months of age.

The data in Table 2 show that infection with coccidia is not strictly dependent on the age of the animal. The highest infection, however, is in antelopes five to 12 months of age (57.7%), and the lowest is in those over a year old (35.8%).

We found Eimeria faurei, E. ninae kohl-jakimov, E. elegans, and a species which we have named Eimeria saiga n. sp. This is the first time that Eimeria faurei has been reported in antelopes. Also, E. elegans is found in the gazelle, and E. ninae kohl-jakimov and E. faurei are parasites of sheep and goats. E. saiga is strictly specific for the antelope. The largest number of oocysts found were those of E. elegans (28.8%), and the smallest number those of E. faurei (1.2%).

Table 3 shows that the highest infection in animals more than a year old occurs in the summer and fall. In animals less than a year old, the infection is high and does not fluctuate during the year. This suggests that the age of the animals does affect the degree of infection.

Eimeria ninae kohl-jakimov Jakimoff and Rastegaieff, 1930

This species was found in 15 (9.2%) antelopes. The oocysts are spherical, short-oval or oval, 18.5 to 28.0 by 21.5 to 32.6 microns with a mean of 24.2 by 27.9 microns. The form-index is 1:0.87. The wall is smooth, double-contoured, greenish, yellow-brown, or orange-brown, 1.2 to 2.0 microns thick. A micropyle is absent. The protoplasm completely fills the fresh oocyst.

The sporocysts are oval, short-oval, or spherical, 7.1 to 11.1 by 7.1 to 12.3 microns with a mean of 8.7 by 9.9 microns. The sporozoites are comma-shaped, 3.5 to 4.8 by 4.4 to 9.5 microns with a mean of 4.1 by 6.9 microns. The oocyst residuum is absent; the sporocyst residuum consists of a granular mass.

The sporulation time is three to four days.

Eimeria elegans Jakimoff, Gusseff and Rastegaieff, 1932

This species was found in 47 (28.8%) antelopes. We have already described the morphology of these oocysts (Svanbaev, 1956).

Eimeria faurei Moussu and Marotel, 1905

This species was found in two antelopes (1.2%). The oocysts are oval or short-oval, 19.5 to 29.6 by 24.7 to 35.4 microns with a mean of 24.0 by 29.9 microns. The form index is 1:0.79 to 0.84 with a mean of 1:0.80. The wall is smooth, double-contoured, yellow-brown, 1.2 to 1.8 microns thick. There is a micropyle, rarely with a cap, at the narrow end of the oocyst. The protoplasmic mass fills the fresh oocyst.

The sporocysts are pear-shaped, oval or short oval, 6.3 to 8.3 by 9.1 to 12.7 microns with a mean of 7.5 by 10.4 microns. The sporozoites are comma-shaped, 3.1 to 3.9 by 7.1 to 10.0 microns with a mean of 3.6 by 8.3 microns. A sporocyst residuum is present.

The sporulation time is three to four days.

Eimeria saiga n. sp.

This species was found in four (2.5%) of 163 antelopes examined. The oocysts (Figs. 1g, 1d, 1e) are spherical, rarely short-oval, 26.8 to 32.4 by 27.6 to 34.4 microns with a mean of 29.5 by 30.5 microns. The form-index is 1:0.93 to 0.97 with a mean of 1:0.97. The wall is smooth, double-contoured, yellow-green or yellow-brown, 1.0 to 1.4 microns thick. A micropyle and cap are absent. In the freshly passed oocyst the protoplasmic mass completely fills the oocyst. As sporulation takes place, the protoplasm contracts and forms a sphere in the center of the oocyst. A polar granule is usually found between the protoplasmic mass and the oocyst wall.

In the mature oocyst the sporocysts are spherical, short-oval, or rarely oval, 7.4 to 9.4 by 7.5 to 12.3 microns with a mean of 8.0 by 9.7 microns. The sporozoites are spherical, short-oval or oval, 3.1 to 4.8 by 4.0 to 6.3 microns with a mean of 4.2 by 4.9 microns. A spherical or oval oocyst residuum and a sporocyst residuum in the form of little scattered granules are present.

The sporulation time is five to seven days.

These oocysts resemble those of Eimeria sajanica Matschoulsky, 1947, but differ from them (Table 4) in the color of the wall, in having a polar granule, in being considerably larger, and in having an oocyst residuum.

CONCLUSIONS

1. In our investigation, we found eight species of Eimeria and one of Isospora in wild ungulates of Kazakhstan.

2. Two new species, I. capreoli and E. saiga are described. New hosts are reported for six species: E. scabra and E. debliecki in the wild boar, E. ninae kohl-jakimov in the gazelle and the [Siberian] goat, E. intricata in the argali, E. parva in the [Siberian] goat, and E. faurei in the [Siberian] goat and [Saiga] antelope. Also this is the first time E. faurei and E. ninae kohl-jakimov have been reported in the argali from Kazakhstan.

3. It was found, by comparing the morphology of the oocysts, that the coccidia of wild ungulates are the same as those of domestic animals with the exception of the following: I. capreoli was found only in roe deer, E. saiga only in antelopes, and E. elegans only in antelopes and gazelles. It is, therefore, possible for cross-transmission of coccidia to occur between wild and domestic animals. Since wild ungulates may be reservoir hosts, it is necessary to consider them as a source of infection for domestic animals when determining prophylactic measures.

4. The youngest animals infected with coccidia were antelopes one-and-a-half months of age.

5. The infection of antelopes with coccidia is not dependent entirely on the age of the host.

6. The heaviest infections with E. ninae kohl-jakimov and E. elegans were found in antelopes 5 to 12 months of age. E. faurei and E. saiga were found in antelopes five months of age and older. E. elegans was seen most often and E. faurei least often.

7. The antelopes of the Prikaspiĭkoĭ lowland appeared to have heavier infections than the antelopes of the desert of Betpak-Dala.

8. Animals more than a year old had heaviest infections in the summer and fall.

FIGURE LEGEND

Fig. 1. Oocysts in various stages of development.

a, b, v - Isospora capreoli n. sp.

g, d, e - Eimeria saiga n. sp.

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TABLE 1

Comparison of Oocysts of I. rangiferis and I. capreoli
(Measurements in microns)

Characteristics	<u>Isospora rangiferis</u> Jakimoff, Spartanskaja and Matschoulsky, 1936	<u>Isospora capreoli</u> nov. sp.
Oocyst shape	Oval, subspherical and spherical	Egg-shaped or pear-shaped
Wall	-	Double-contoured, smooth, internal with radial striations, 2.0-4.0 thick
Color of wall	-	Yellow-brown or brown
Microspyle	None	Present. 3.8-4.7 wide
Oocyst size	Oval and subspherical 26.0-32.0 x 24.0-30.0, with a mean of 29.5 x 24.5; spherical 24.0	40.3-46.0 x 28.1-32.4 M 43.3 x 30.8
Shape of protoplasm	-	In fresh oocyst is a sphere and contracted away from wall
Polar granule	Present	Absent
Form-index	1:0.69-0.94, M 1:0.84	M 1:0.71
No. of sporocysts	2, oval or spherical	2, pear-shaped, egg-shaped and oval
Size of sporocysts	12.0-16.0 x 8.0-12.0	18.9-24.5 x 10.7-15.8, M 21.7 x 13.5
Sporozoites in sporocysts	4, in form of bulky commas	4, pear-shaped or comma-shaped
Size of sporozoites	-	8.3-13.0 x 3.2-4.2, M 11.0 x 3.9
Residual body	Only in sporocysts in form of scattered granules	Only in oocysts, short oval 8.8 x 8.0
Sporulation time	-	3-4 days

TABLE 2

Infection of [Saiga] Antelopes According to Age with Various Species of Coccidia

Age of Animals	West-Kazakhstan Region			Desert of Betpak-Dala			Total			E. niniae kohl-jakimov		E. faurei		E. elegans		E. saiga	
	No. Examined	No. Infected	% Infected	No. Examined	No. Infected	% Infected	Total Examined	Total Infected	% Infected	No. Infected	% Infected	No. Infected	% Infected	No. Infected	% Infected	No. Infected	% Infected
Up to 5 months	11	5	45.5	3	1	33.3	14	6	42.9	1	7.1	-	-	5	35.7	-	-
5-12 months	8	5	62.5	18	10	55.5	26	15	57.7	4	15.4	1	3.8	10	38.5	1	3.8
Older than a year	56	27	48.2	67	17	25.4	123	44	35.8	10	8.1	1	0.8	32	26.0	3	2.4
Total	75	37	49.3	88	28	31.8	163	65	39.9	15	9.2	2	1.2	47	28.8	4	2.5

TABLE 3

Infection with Coccidia of [Saiga] Antelopes of Various Ages in Different Seasons of the Year

Age of Animals	Periods of Examination														
	Spring			Summer			Autumn			Winter			Total		
	No. Examined	No. Infected	% Infected	No. Examined	No. Infected	% Infected	No. Examined	No. Infected	% Infected	No. Examined	No. Infected	% Infected	No. Examined	No. Infected	% Infected
Up to 5 months	-	-	-	14	6	42.9	-	-	-	-	-	-	14	6	42.9
5-12 months	5	3	60	3	2	66.7	5	4	80	13	6	46.2	26	15	57.7
Older than a year	19	2	10.5	54	30	55.6	20	6	30	30	6	20	123	44	35.8
Total infected	24	5	20.8	71	38	53.5	25	10	40	43	12	27.9	163	65	39.9

TABLE 4

Comparison of E. sajanica and E. saiga Oocysts
(Measurements in microns)

Characteristics	<u>Eimeria sajanica</u> Matschoulsky, 1947	<u>Eimeria saiga</u> n. sp.
Oocyst shape	Oval or spherical	Spherical, rarely short-oval
Wall	Double-contoured, up to 1.0 thick	Smooth, double-contoured, 1.0-1.4
Color of wall	Colorless	Yellow-green or yellow-brown
Oocyst size	18.2-23.1 x 16.5-19.8 M 20.7 x 18.3	27.6-34.4 x 26.8-32.4 M 30.5 x 29.5
Form-index	1:0.80-0.92, M 1:0.87	1:0.93-0.97, M 1:0.97
Protoplasm form	-	Fills entire fresh oocyst
Polar granule	Absent	Present
Number of sporocysts	4, oval	4, spherical, short-oval, rarely oval
Size of sporocysts	5.0-9.9 x 3.3-5.0	7.5-12.3 x 7.1-9.4, M 9.7 x 8.0
Number of sporozoites/sporocysts	2	2, spherical, short-oval or oval
Size of sporozoites	-	4.0-6.3 x 3.1-4.8, M 4.9 x 4.2
Residual body	Only in sporocysts	Present in oocyst and sporocyst
Sporulation time	-	5-7 days