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THE SPECIES OF EIMERIA OCCURRING IN CATTLE IN TURKEY

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Climatic conditions in many parts of Turkey are suitable for sporulation and survival of coccidia oocysts. Routine faecal examinations in our laboratory show that cattle discharge a wide variety of oocysts during all seasons of the year and a hundred percent incidence of infection is frequently encountered in healthy herds. Clinical coccidiosis is also known to be present in calves and has been considered important for economic losses.

In recent years a survey of oocysts occurring in the faeces of cattle in neighbourhood of Ankara was carried out and eight species of *Eimeria* were identified (22). The identification was based on the morphological criteria of their unsporulated oocysts alone, but recent works (17, 18, 19, 23, 31) have shown that sporulated oocysts are necessary for valid differentiations. Indeed there is practically not enough information on the occurrence of the various species of *Eimeria* present in cattle in this country (35).

The purpose of this paper is to set out the results obtained from a survey of faecal specimens which were examined in order to determine the species of *Eimeria* present in cattle in Turkey and to provide a brief note on the diagnostic features of oocysts of these species for the guidance of workers interested in the disease in this country.

Materials and Methods

The present study is based on the examination of sporulated oocysts of *Eimeria* species from the faeces of 150 cattle. The faecal

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samples were obtained from rectums of apparently healthy animals during the period of 1966 to 1968. The animals were from the provinces of Ankara, Kayseri, Konya, Çorum, Yozgat, Amasya, Eskişehir, Samsun, Erzurum, Erzincan, Malatya, Adana, Bolu, Adapazarı and Afyon. The ages of the animals varied from 2 months to 12 years old.

After washing and straining of the faecal samples, the oocysts were concentrated by centrifugal flotation technic with Sheather's sugar solution for their discovery. The samples which contained the oocysts of *Eimeria* species were mixed with 2.5 % Potassium Dichromate solution and placed in a thin layer in a Petri dish at room temperature to permit the coccidian oocysts to sporulate. The sporulated oocysts were concentrated by the technic which was mentioned above prior to examination for their identification. They were examined with Leitz microscope equipped with apochromatic objectives. The pictures of the sporulated oocysts were drawn by hand or were taken by microphotography apparatus.

Results

Identification of Species :

150 faecal specimens were examined between February 1966 and March 1968. The following 11 species of *Eimeria* were identified: *Eimeria alabamensis* Christensen 1941; *Eimeria auburnensis* Christensen and Porter, 1939; *Eimeria bovis* (Zublin, 1908) Fiebiger, 1912; *Eimeria brasiliensis* Torres and Ramos, 1939; *Eimeria bukidnonensis* Tubangui, 1931; *Eimeria canadensis* Bruce, 1921; *Eimeria cylindrica* Wilson, 1931; *Eimeria ellipsoidalis* Becker and Frye, 1929; *Eimeria illinoisensis* Levine and Ivens, 1967; *Eimeria subspherica* Christensen, 1941; *Eimeria zuernii* (Rivolta, 1878) Martin, 1909.

The sporulated oocyst of each species is described below in detail.

Eimeria alabamensis Christensen, 1941

In the present survey 50 sporulated oocysts from 5 animals were studied. The oocysts are ovoid and small. Oocyst wall is thin, smooth, transparent, pale yellow in colour and composed of a single layer. It is lined with a membrane. Micropyle, oocyst residuum, oocyst polar granule and sporocyst residuum are not present. Sporulation of oocyst is completed in about 5 days at room temperature. Sporocysts are elongate and have a stieda body. Each of them has 2 clear globules (plate I and II, figure 1). The measurements of oocysts are shown in table 1.

Eimeria auburnensis Christensen and Porter, 1939

In this investigation 50 sporulated oocysts answering to the following description of *E. auburnensis* recovered from 5 host animals were studied. The oocysts are elongate ovoid in shape. Oocyst wall is either smooth or scabrous. It is yellowish brown in colour and composed of a single layer and lined by a thin membrane. Micropyle is present at the small end of oocyst. Micropylar cap is absent, but polar granule present. Sporulated oocyst does not have oocyst residuum. Sporocysts are elongate, almost ellipsoidal, but with one end smaller than the other. Stieda body and sporocyst residuum are present. Sporozoites are elongate with one end broader than the other. They have one large globule in the large end and one small globule elsewhere. Sporulation of oocyst is completed in about 3 days at room temperature (plate I and II, figure 2 and 2 a). The measurements of oocysts and sporocysts are shown in table 1.

Eimeria bovis (Zublin, 1908) Fiebiger, 1912

The following description is based on the study of 50 sporulated oocysts obtained from 5 cows. The oocysts are broadly ovoid and becoming narrower at micropylar end. Oocyst wall is smooth and composed of two layers. Micropyle is present at the small end of oocyst. Oocyst residuum and polar granules are absent. Sporocysts are elongate ovoid and have stieda bodies at their small ends. Sporocyst residuum is present. Sporozoites are banana shaped and have two refractile globules of which large one situated near the posterior end and small one near the anterior end. The oocysts required 2 to 3 days to complete their sporulations (plate I and II, figure 3). Measurements of oocysts and sporocysts are shown in table 1.

Eimeria brasiliensis Torres and Ramos, 1939

In this survey 50 sporulated oocysts from 5 cattle were studied. Oocysts are ellipsoidal with the relatively straight sides curving sharply near the poles. Oocyst wall is brownish yellow, smooth, somewhat thicker at the micropylar end and composed of a single layer. Micropyle and polar cap are present, but oocyst residuum and polar granule absent. There is a subpolar body which is a characteristic of this species. Sporocysts are elongate ellipsoidal with relatively narrow ends. Stieda body is absent. Sporocyst residuum is present and composed of more or less scattered granules. Sporozoites are elongate with one large clear globule at each end. Sporulation of oocysts are completed in about 6 days at room temperature. The measurements of oocysts and sporocysts are shown in table 1. The figures of oocysts are also shown in plate I and II (fig. 4)

Eimeria bukidnonensis Tubangui, 1931

The following description is based on the study of 50 sporulated oocysts from 5 cattle. The oocysts are either perfectly pear shaped or oval tapering to a point at one end. They are yellowish brown in colour. Oocyst wall is radially striated, composed of a single layer about 2.5 to 3.5 microns thick and lined by a membrane which may be slightly wrinkled at the small end. The surfaces of oocysts are either smooth or scabrous. Micropyle is about 4.5 microns in diameter at the small end of oocyst. Oocyst residuum and polar granule are absent. Sporocysts are elongate, somewhat pointed at both ends with inconspicuous stieda body. Sporocyst residuum is also absent. Sporozoites with one end wider than the other have a large globule at each end. Sporulations of oocysts require about 5 to 7 days at room temperature (Table I and II, figure 5 and 5 a). The dimensions of oocysts and sporocysts are shown in table 1.

Eimeria canadensis. Bruce, 1921

50 sporulated oocysts answering to the following description of *E.canadensis*, obtained from 5 cows, were studied.

Oocysts are slightly ovoid or ellipsoidal in shape. Oocyst wall is smooth and composed of two layers. The outer one is colourless and thicker over the micropyle, while inner one yellowish brown and thinner over the micropyle. It is lined by a thin membrane. Micropyle is present, but inconspicuous, at the small end of oocyst. Oocyst residuum and polar granules are absent. Sporocysts are elongate ovoid, with one end somewhat broader than the other. Stieda body is present but inconspicuous. Sporocyst residuum is composed of a small number of scattered granules in some sporocysts, a large number granules in others. Sporozoites are elongate and each of them has 2 to 3 clear globules. Sporulations of oocysts are completed in 3 to 5 days at room temperature (plate I and II, figure 6). The dimensions of oocysts and sporocysts are shown in table 1.

Eimeria cylindrica Wilson, 1931

In this investigation, 50 sporulated oocysts from 5 animals were studied. Oocysts are elongate ellipsoidal, with relatively straight sides. Oocyst wall is thin, smooth, transparent or yellowish in color and composed of a single layer. Micropyle is inapparent. Oocyst residuum and polar granule are not present. Sporocysts are elongate and do not have stieda bodies. They have sporocyst residuum. Sporozoites are banana shaped and have two refractile globules. Sporulations of oocysts are completed in two days at room temperature (plate

I and II, figure 7). The measurements of oocysts and sporocysts are shown in table 1.

Eimeria ellipsoidalis Becker and Frye, 1929

The following description is based on the study of 50 sporulated oocysts recovered from 5 cattle.

Oocysts are ellipsoidal to slightly ovoid. Oocyst wall is thin, homogeneous, transparent and composed of a single layer. It is lined with a fine membrane which is wrinkled at the micropylar end. Micropyle and polar cap are not present. Oocyst residuum is absent, but sporocyst residuum present. Sporocysts are elongate ovoid with a inconspicuous stieda body at small end. Sporozoites are elongate with one broad end and each of them has 2 clear globules. Sporulations of oocysts require 2 to 3 days at room temperature (plate I and II, figure 8). Measurements of oocysts and sporocysts are shown in table 1.

Eimeria illinoisensis Levine and Ivens, 1967

The following information is based on the study of 20 sporulated oocysts from 2 cattle.

Oocysts are typically ellipsoidal. Oocyst wall is smooth, colourless, thick and composed of a single layer. Micropyle is not present, but one end of oocyst wall is thinner and flatter than the other. Oocyst residuum and oocyst polar granule are not present. Sporocysts are elongate ovoid with a conspicuous stieda body. Sporocyst residuum is present and consists of a compact, granular ball. Sporozoites are elongate with one end larger than the other and have two clear globules. Sporulations of oocysts are completed in 3 to 4 days at room temperature (plate I and II, figure 9). The measurements of oocysts and sporocysts are shown in table 1.

Eimeria subspherica Christensen, 1941.

The following description is based on the study of 25 sporulated oocysts from 2 cattle.

Oocysts are spherical to subspherical in shape. Oocyst wall is thin, smooth, pale yellowish and composed of a single layer. Micropyle, oocyst residuum and polar granule are absent. Sporocysts are spindle shaped with small stieda body. Sporocyst residuum is not present. Sporozoites which are wider at one end than the other have a refractile globule at their large end. Sporulations of oocysts are completed in 4 days at room temperature (plate I and II, figure 10). The measurements of oocysts and sporocysts are shown in table 1.

TABLE: 1
Summary of morphological characteristics of *Eimeria* species of cattle in Turkey*

| Species | | Range in length | Mean length | Range in width | Mean width | Range in length width ratio | Mean length width ratio |
|-------------------------|---|-----------------|-------------|----------------|------------|-----------------------------|-------------------------|
| <i>E. alabamensis</i> | O | 18.8-26.4 | 21.3 | 14.2-17.8 | 15.1 | 1.3-1.9 | 1.4 |
| | S | 13.0-18.0 | 14.2 | 4.7- 6.1 | 4.9 | 2.2-4.3 | 2.4 |
| <i>E. auburnensis</i> | O | 35.9-43.2 | 41.2 | 23.0-28.0 | 25.6 | 1.6-1.9 | 1.8 |
| | S | 16.0-21.0 | 17.8 | 8.0- 9.0 | 8.5 | 2.0-2.2 | 2.1 |
| <i>E. bovis</i> | O | 25.4-32.9 | 28.2 | 18.3-22.6 | 20.2 | 1.3-1.7 | 1.5 |
| | S | 15.0-18.0 | 16.9 | 7.0- 9.0 | 7.8 | 2.0-2.4 | 2.2 |
| <i>E. bukidnonensis</i> | O | 38.0-48.0 | 43.2 | 28.0-36.0 | 32.9 | 1.3-1.4 | 1.2 |
| | S | 14.7-19.5 | 16.9 | 9.1-12.4 | 10.1 | 1.5-1.8 | 1.6 |
| <i>E. brasiliensis</i> | O | 36.2-40.4 | 38.5 | 25.3-28.2 | 26.8 | 1.5-1.7 | 2.5 |
| | S | 18.2-22.3 | 20.8 | 8.7-10.5 | 9.2 | 2.2-2.8 | 2.5 |
| <i>E. canadensis</i> | O | 28.4-38.9 | 33.6 | 22.0-29.0 | 24.3 | 1.4-1.8 | 1.6 |
| | S | 15.0-18.0 | 16.1 | 7.0- 9.9 | 8.1 | 2.2-2.9 | 2.5 |
| <i>E. cylindrica</i> | O | 18.5-30.2 | 24.8 | 12.3-17.2 | 14.9 | 1.7-2.1 | 1.9 |
| | S | 12.0-17.0 | 14.2 | 4.0- 7.0 | 6.2 | 2.1-3.4 | 2.7 |
| <i>E. ellipsoidalis</i> | O | 18.0-28.0 | 22.9 | 14.0-20.0 | 16.8 | 1.3-1.9 | 1.5 |
| | S | 12.0-17.0 | 14.2 | 6.0- 7.0 | 5.9 | 2.4-2.9 | 2.5 |
| <i>E. illinoisensis</i> | O | 25.0-30.0 | 26.8 | 20.0-23.0 | 21.2 | 1.4-1.7 | 1.5 |
| | S | 13.4-16.9 | 15.6 | 6.9- 8.1 | 7.1 | 2.4-2.9 | 2.5 |
| <i>E. subspherica</i> | O | 10.0-14.0 | 12.2 | 9.0-13.0 | 11.1 | 1.0-1.2 | 1.0 |
| | S | 6.0-10.0 | 7.9 | 2.0- 4.0 | 3.2 | 1.9-3.1 | 2.3 |
| <i>E. zuernii</i> | O | 18.0-24.0 | 20.9 | 13.0-20.0 | 16.8 | 1.2-1.5 | 1.3 |
| | S | 10.0-14.0 | 11.7 | 5.0- 8.0 | 6.1 | 1.7-2.8 | 2.1 |

O: Oocysts

S: Sporocysts

*: Measurements in microns

Eimeria zuernii (Rivolta, 1878) Martin, 1909

The following description is based on the study of 75 sporulated oocysts from 10 animals.

Oocysts are spherical, subspherical or bluntly ellipsoidal in shape. Oocyst wall is smooth, colourless and composed of a single layer. Micropyle and oocyst residuum are absent. Polar granule may or may not be present. Sporocysts are elongate ovoid with a small stieda body. Sporocyst residuum is present. Sporozoites are banana shaped and have a refractile globule at their broad ends. Oocysts require 3 days

to complete their sporulation at room temperature (plate I and II, figure 11). The measurements of oocysts and sporocysts are shown in table 1.

Incidence :

The present survey shows that coccidia infection is observed in most cattle which are clinically healthy and varying in age from 2 months to 12 years. 140 out of 150 (93.33 %) cattle were found to be infected with coccidia by the examination of faecal specimens collected from them. The total numbers of oocysts recorded by the centrifugal flotation technique in 10 Gr. samples of faeces ranged from 0 to 15,750. The numbers of species observed in positive individual samples ranged from one to seven. An analysis of the incidence of different species indicated that multiple infections were common, but these were usually consisted of two or three species only. The incidence of infection which consisted of more than three species was not considerable level. *Eimeria bovis*, *E.auburnensis*, *E.ellipsoidalis* and *E.zuernii* were the predominant species. They were followed by *E.canadensis*, *E.cylindrica*, *E.bukidnonensis*, *E.subspherica*, *E.brasiliensis*, *E.alabamensis* and *E.illinoisensis* respectively. The findings of the survey are summarized (table 2).

TABLE: 2

Results of a survey conducted in 1966 and 1968 to determine of bovine coccidia in 15 provinces of Turkey.

| species | incidence in sample | percentage of the total | distribution by provinces |
|-------------------------|---------------------|-------------------------|---------------------------|
| <i>E. alabamensis</i> | 6 | 4.2 | 2 |
| <i>E. auburnensis</i> | 81 | 57.8 | 15 |
| <i>E. bovis</i> | 82 | 58.5 | 15 |
| <i>E. brasiliensis</i> | 7 | 5.0 | 4 |
| <i>E. bukidnonensis</i> | 10 | 7.1 | 6 |
| <i>E. canadensis</i> | 37 | 26.1 | 9 |
| <i>E. cylindrica</i> | 11 | 7.8 | 4 |
| <i>E. ellipsoidalis</i> | 70 | 50.0 | 12 |
| <i>E. illinoisensis</i> | 2 | 1.6 | 1 |
| <i>E. zuernii</i> | 43 | 30.7 | 11 |
| <i>E. subspherica</i> | 8 | 5.6 | 3 |

This survey shows that different species of Eimeria are found in hosts of different ages during all seasons of the year.

Discussion

Many species of Eimeria have been proposed and described from cattle in literature (1,2,18,19,25,26,8,11). Some of these are presently considered valid while others are not (2,6,18,24,26).

E.alabamensis was named and described from Alabama cattle by Christensen (6). His description agrees in essential with ours, except that we and Levine and Ivens (18) did not see subellipsoidal or subcylindrical oocysts. The oocysts found in Nigerian (17), English (16) and American (18) cattle are essentially similar to those described in the present paper.

E.auburnensis was first reported from Alabama cattle and its oocysts described in some detail by Christensen and his coworker (6, 7). Our form is similar to theirs, except that they did not mention oocyst polar granule. Both Nyberg and Hammond (23), Levine and Ivens (18) agree with us about the presence of oocyst polar granule. The oocysts of *E.auburnensis* described by different authors from American (18, 23), English (16) and Nigerian (17) cattle are essentially similar to those reported from Turkish cattle.

In classifying ovoidal oocysts intermediate in size between *E.alabamensis* and *E.auburnensis*, Christensen (6) retained the name *E.bovis* and synonymized *E.smithi* with it. He also described its oocysts in detail. In our survey ovoidal oocysts of this type were found to be almost identical with specimens recorded by Christensen (6). The oocysts of *E.bovis* described from American (18, 23), English (16) and Nigerian (17) cattle were essentially the same as ours, except that Joyner et al (16) showed no stieda body on the sporocysts in their figure. Both Nyberg and Hammond (23) and Levine and Ivens (18) agree with us about the presence of it.

In a report on the coccidia oocysts of cattle in Brezil, Torres and Ramos (33) described *E.brasiliensis* as a new species. Its oocysts were reported from English (16), American (18, 20, 6) and Nigerian (17) cattle and described in detail. Our oocysts did not differ significantly from any of these.

E.bukidnonensis was originally described from cattle in Philippine (34) and subsequently obtained both from cattle (6,9,13,16, 17,32,38) and buffalo (24) in other countries. Christensen (6), Levine and Ivens (18), Lec and Armour (17) and Joyner et al (16) described the oocysts of this species. Our material agrees with the descriptions given by above authors except that some of the oocysts obtained from Turkish cattle have scabrous surface and oocyst dimensions given by Christensen (6) are considerably smaller than those indicated in this paper. The oocysts of *E.bukidnonensis* figured previously by Mimioğlu et al (22) from Turkish cattle are distinctly different from ours. Their form obviously represents *E.bovis* -rather than *E.bukidnonensis*- with broadly ovoid in shape and thin wall without radial striation.

In a report, Bruce (5) described coccidia oocysts from a calf in British Columbia as *E.canadensis* which included forms resembling *E.zuernii* and *E.bovis* as well as some larger ellipsoidal or ovoidal types. He was actually dealing with a mixture of *E.zuernii*, *E.bovis* and *E.canadensis*. Therefore, Christensen (6) restricted the name *E.canadensis* to only Bruce's large oocysts and described the unsporulated oocysts in detail. Our form is similar to his. Levine and Ivens (18), Lee and Armour (17) described the sporulated oocysts in detail from American and Nigerian cattle respectively. Our form is similar to theirs. The oocysts figured by Joyner et al (16) from English cattle did not differ significantly from ours.

E.cylindrica was created by Wilson (36) and has been recognized by Becker (1), Christensen (6), Hardcastle (12) and Bougton (4). Christensen (6) and Marquardt (21) described its oocysts and discussed the distinction between *E.cylindrica* and *E.ellipsoidalis*. Levine and Ivens (18), Lee and Armour (17) described sporulated oocysts in detail. The oocysts described by the above authors as well as those figured by Joyner et al (16) were essentially the same as ours.

E.ellipsoidalis was first reported as a new species by Backer and Frye (3) from cattle in Iowa, U.S.A. Its oocysts were also reported from American (6,18,23,21,13), Nigerian (17), English (16) and Austrian (32) cattle and described by Christensen (6), Marquardt (21), Levine and Ivens (18), Nyberg and Hammond (23), Lee and Armour (17) in detail. Our oocysts are very similar to theirs.

E.subspherica was named and described from Alabama cattle by Christensen (6). His description agrees in essential with ours. The oocysts described by Levine and Ivens (18), Lee and Armour (17) and Joyner et al (16) from American, Nigerian and English cattle respectively are not different from those described in our report.

E.zuernii and *E.bovis* were first reported from cattle (1) and subsequently held valid as separate species. The name *E.zuernii* was restricted for the round form. The actual descriptions of its oocysts were given by Wilson (36), Christensen (6), Nyberg and Hammond (23), Levine and Ivens (18) from American cattle, by Lee and Armour (17) from Nigerian cattle, by Supperer (32) from Austrian cattle. Our form is similar to theirs. The oocysts of *E.zuernii* figured by Joyner et al (16) from English cattle is also same as ours.

E.illinoisensis was first named and described by Levine and Ivens (18) from cattle in Illinois, U.S.A. It was held valid species because of its oocysts which have a large and broad appearance and

a thick, dark and single-rather than a double-layer wall. The oocysts of *E.illinoisensis* described by above authors did not differ from those described in this paper.

Three additional species of *Eimeria* which were described from cattle have been considered valid. They are *E.pellita* which was reported from both Austria (32) and England (16); *E.wyomingensis* from U.S.A. (15, 18), England (16) and Nigeria (17); and *E.thianethi* from Russia (10). Neither of these species have been found in cattle in Turkey. However *E.wyomingensis* was recorded from buffalo (31).

The species such as *E.boehmi* (32), *E.orlovi* and *E.helene* (25, 26), *E.gogaki* and *E.aereyi* (28), *E.khurodensis* and *E.bombayensis* (29), *E.ildofensi* (33), *E.mundaragi* (14) and *E.zurnabadensis* (37) which were described from cattle are not presently considered valid. *E.boehmi*, *E.orlovi*, *E.helene* (18, 25, 26) and *E.gogaki* (24) were synonymized with *E.brasiliensis*. *E.khurodensis* (19), *E.ildofensi* (18, 25), *E.bombayensis* (25) and *E.mundaragi* (24) were listed as being synonymous with *E.auburnensis*, and *E.bombayensis* (24), *E.zurnabadensis* (19, 25) with *E.canadensis*.

On the other hand the species of *Eimeria* such as *E.ovoidalis* (30), *E.bareillyii* (25), *E.azerbaidjanica* (38) and *E.ankaransis* (31) described from buffalo were not found in Turkish cattle. Patnaik (24) thinks that *E.ovoidalis* and *E.azerbaidjanica* are synonym with *E.wyomingensis*.

In Turkey, *E.alabamensis*, *E.auburnensis*, *E.bovis*, *E.canadensis*, *E.ellipsoidalis*, *E.zuernii* and *E.subspherica* were previously reported from both cattle (22) and buffalo (31); *E.brasiliensis*, *E.cylindrica*, *E.wyomingensis* and *E.ankaransis* from buffalo only (31). The present paper indicates that *E.bukidnonensis*, *E.brasiliensis*, *E.cylindrica* and *E.illinoisensis* have been also found in cattle in this country.

Summary

A survey has been made to determine the species of *Eimeria* in cattle in Turkey. 140 out of 150 (93.33 %) clinically healthy animals were found to be infected with 11 *Eimeria* species. They were 4.2 % *E.alabamensis*, 57.8 % *E.auburnensis*, 58.5 % *E.bovis*, 5.0 % *E.brasiliensis*, 7.1 % *E.bukidnonensis*, 26.1 % *E.canadensis*, 7.8 % *E.cylindrica*, 50.0 % *E.ellipsoidalis*, 1.6 % *E.illinoisensis*, 5.6 % *E.subspherica*, 30.7 % *E. zuernii*.

The sporulated oocysts of these species were described in detail.

Özet

Türkiye'de sığırlarda bulunan Eimeria türleri
üzerinde araştırmalar

Daha önceki yıllarda bu konuyla ilgili olarak Ankara ve civarındaki sığırlar üzerinde bir araştırma yapılmış ve 8 Eimeria türünün bulunduğu bildirilmiştir (22). Fakat tür tayini sporlanmamış oocystlerin özelliklerine göre yapılmıştır. Halbuki son yıllarda bu metodun hatalı olduğu anlaşılmış ve türlerin doğru olarak tayin edilebilmesi için sporlu oocystlerin özelliklerinin göz önünde bulundurulmasının zorunlu olduğu ortaya çıkmıştır.

Bu nedenle Türkiye'de sığırlarda bulunan Eimeria türlerinin, sporlanmış oocystlerine göre, yeniden tayin edilmesi ve insidenslerinin ortaya konması araştırmamızın amacını teşkil etmiştir. Bu amaca ulaşmak için Şubat 1966 ve Mart 1968 yılları arasında Türkiye'nin çeşitli bölgelerinden (Ankara, Kayseri, Konya, Çorum, Yozgat, Amasya, Eskişehir, Samsun, Erzurum, Erzincan, Malatya, Adana, Bolu, Adapazarı ve Afyon), değişik yaşlarda (2 aylık-12 yıl) ve sağlam görünüşlü 150 sığırın rektumundan alınan dışkı numuneleri tahlil edilmiştir. Santrifüj flotasyon tekniği ve doymuş şekerli su kullanılarak dışkı numunelerinde oocystlerin bulunup bulunmadığı araştırılmıştır. Oocystlerin bulunduğu dışkı numuneleri % 2.5 Potassium Dichromate solüsyonu ile karıştırılmış ve mevcut oocystlerin sporlanması temin edilmiştir. Sporlu oocystlerin çeşitli özellikleri apokromatik objektifle incelenmiştir. Türleri tayin için, genellikle, 2-5 hayvandan elde edilen her bir türe ait 25-75 sporlu oocystlerin özellikleri gözden geçirilmiştir.

Muayene edilen 150 sığırdan 140'ının (% 93.33) çeşitli Eimeria türleri ile enfekte oldukları anlaşılmıştır. Bu sığırlarda total olarak 11 Eimeria türü tesbit edilmiştir. Bunlar *E.alabamensis* (% 4.2), *E.auburnensis* (% 57.8), *E.bovis* (% 58.5), *E.brasiliensis* (% 5.0), *E.bukidnonensis* (% 7.1), *E.canadensis* (% 26.1), *E.cylindrica* (% 7.8), *E.ellipsoidalis* (% 50), *E.illinoisensis* (% 1.6), *E.subspherica* (% 5.6), *E.zuernii* (% 30.7)'den ibarettirler. Bunlardan *E.brasiliensis*, *E.bukidnonensis*, *E.cylindrica* ve *E.illinoisensis*'in Türkiye'de sığırlarda mevcudiyeti ilk defa bu araştırma ile ortaya konmuştur. Daha önce Ankara ve civarındaki sığırlar üzerinde yapılan araştırmada (22) *E.bukidnonensis*'in varlığı bildirilmiş ise de, teşhisin doğru olmadığı mesaide resmedilen oocystden anlaşılmaktadır. İnce kabuğu ve tipik ovoid şekli ile bu oocyst'ün *E.bukidnonensis*'den çok *E.bovis*'e ait olduğu görülmektedir. *E.bukidnonensis*'in oocyst'leri, daha önce de zikredildiği gibi, gayet tipik olup armut şeklinde ve üye-

rinde radial çizgiler bulunan kalın kabuğa sahiptir (Plate I,II ve şekil 4).

Yukarda adı geçen *Eimeria* türleri genellikle sığırlarda karışık enfeksiyon halinde bulunmuşlardır. Bazılarına saf enfeksiyon şeklinde de rastlanmıştır. Enfekte hayvanların her birinde en az 1, en çok 7 *Eimeria* türü bulunmuştur. 150 hayvandan alınıp tahlil edilen dışkı numunelerinin herbirinin 1 gramında bulunan oocyst sayısının 0-15750 arasında değiştiği anlaşılmıştır. Yukarda bildirilen *Eimeria* türlerinden en çok *E.bovis*, *E.auburnensis*, *E.ellipsoidalis* ve *E.zuernii*'ye rastlanmıştır ve bu türlerin oocystlerinin, dışkı numunelerinde, diğer türlerin oocystlerine nazaran daha kesif olduğu görülmüştür.

Türkiye'de sığırlarda bulunan *Eimeria* türlerinin sporlanmış oocystleri ayrıntılı olarak metinde tarif edilmiştir. Bunlar mesainin tartışma bölümünde diğer ülkelerdeki araştırmacıların görüşleri ile karşılaştırılmıştır. Yine mesainin tartışma bölümünde çeşitli ülkelerde çeşitli araştırmacılar tarafından sığırlarda mevcudiyeti bildirilen ve bugün muteber ya da sinonim kabul edilen *Eimeria* türlerinden söz edilmiş ve bunlar hakkındaki eleştiriler üzerinde durulmuştur.

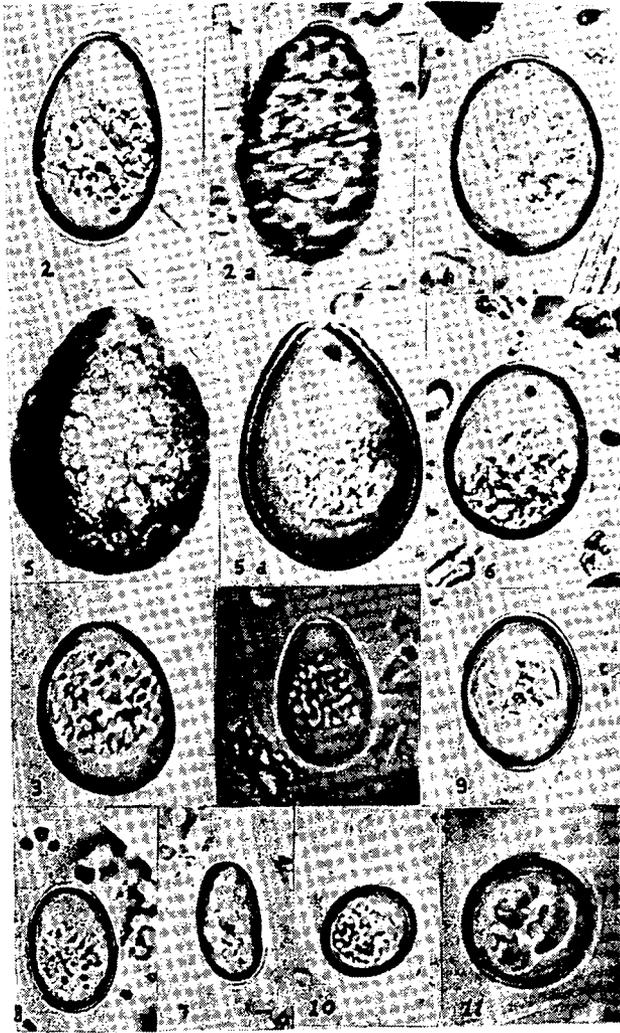
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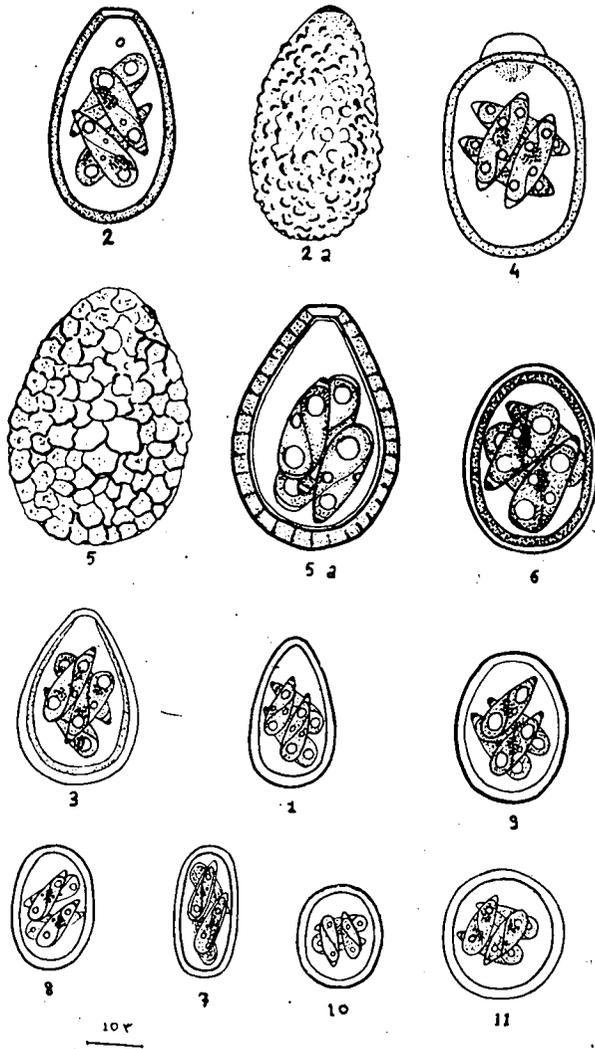
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The unsporulated cocysts of *Eimeria* species in cattle
 Figures: 2 and 2a- *Eimeria auburnensis*, 4- *E. brasiliensis*, 5 and 5a- *E. bukidnonensis*, 6 - *E. canadensis*, 3- *E. bovis*, 1- *E. alabamensis*, 9- *E. illinoisensis*, 8- *E. ellipsoidalis*, 7- *E. cylindrica*, 10- *E. subspherica*, 11- *E. zuernii*. x 1000



The sporulated oocysts of *Eimeria* species in cattle

Figures: 2 and 2a- *Eimeria auburnensis*, 4- *E. brasiliensis*, 5 and 5a- *E. bukidnonensis*, 6- *E. canadensis*, 3- *E. bovis*, 1- *E. alabamensis*, 9- *E. illinoisensis*, 8- *E. ellipsoidalis*, 7- *E. cylindrica*, 10- *E. subspherica*, 11- *E. zuernii*.