

THE COCCIDIA SPECIES PARASITIZING THE DOMESTIC GOAT IN NIGERIA

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OBSTRACT

Nine fully recognised and described species of coccidia in goats and also one species not previously described are identified. Size, shape, colour, sporulation time, morphology of unsporulated oocysts were the criteria for species identification. 30 out of 36 faecal samples were positive for single or mixed infections with 3 samples being pure infections of single species. The unidentified species has a low occurrence and probably is not of importance in clinical coccidiosis in goats.

The sporulation time for different species is found to be directly related to the size of the oocysts. As most species sporulate within 48 hours, daily removal of faecal materials from goat pens is recommended.

INTRODUCTION

Many workers in the Faculty of Veterinary Medicine of the University of Ibadan using goats for their experiments had noticed that most of the goats went down with Coccidiosis, thus creating conditions affecting their work. The determination of the sporulation time has direct application in providing useful information in goat husbandry and control of clinical outbreak of coccidiosis in intensive goat rearing establishments.

In Nigeria, like in the temperate regions of the world, very little work has been done on the coccidia species of goats. Most of the literature have been on sheep as hsheep rearing is more important on the global scale. An earlier work by Fabiyi (1973) identified some coccidia species in Goat and Sheep in Benue-Plateau area of Nigeria. Some workers in other parts of the world, Balozet (1932); Honess (1942) and Krilov (1961) found identical species in sheep and goats but cross infection experiments by these workers showed that

oocysts from sheep do not infect goats.

MATERIALS AND METHODS

Peelleted faeces were taken fresh from about 40 goats over a period of 3 months slaughtering in the University of Ibadan zoo. The goats were mainly from the Northern States of Nigeria and a few southern dwarf goats. To tandardise the conditions, all the faecal pellets were taken directly from the colons of the goats during slaughter. All cultures were grown inside petri-dishes kept at room temperature which at Ibadan fluctuates normally between 25°C and 27°C. 35% sugar solution was used for flotation of oocysts while 2.5% Potassium dichromate solution was added to all control cultures.

Identification of oocysts:

FLOATATION METHOD: as described by Christensen (1938a) and Levine *et. al.* (1962).

DETAILED MORPHOLOGICAL PROCEDURES:

Loopfuls of floated oocysts from flotation were collected and mixed with physiological Saline (0.9% NaCL) saturated with Eosin and 5% Potassium Iodide solution. These were allowed to stain for ten minutes. The stained oocysts were then examined microscopically and detailed morphological descriptions with measurements recorded.

DETERMINATION OF SPORULATION TIME OF EIMERIA OOCYSTS UNDER DIFFERENT OCNDITIONS:

Faeces for each trial were taken from the same goats. These were divided into parts in petri-dishes and subjected to the following different conditions, simulation pen and field environmental conditions. Samples were taken at intervals and examined for the presence of sporulated oocysts. Oocysts with four sporocysts were taken as fully sporulated.

a. In faecal Pellets dried in air:

Freshly obtained faecal pellets were placed in open petri-dishes and allowed to stand at room temperatures (25—27°C). At intervals, part of the pellets were taken, crushed and oocysts demonstrated using method I, (see Table 2).

b. In faecal pellets kept under 5mm of tap water:

Fresh faecal pellets were kept under 5mm of tap water inside petri-dishes and allowed to stand for days. Sporulation time of oocysts were determined (see Table 2).

c. In faecal pellets kept under 5mm of 2.5% Potassium dichromate Solution:
Some procedures as in IIIb using 2.5% Potassium dichromate solution.

d. In faecal suspension in water:

Freshly obtained faeces from a batch earlier confirmed to be positive for coccidia was crushed and run through a 40 mesh per inch sieve using tap water. The faecal suspension was then left at room temperature in a petri-dish. Part of this suspension was taken at intervals and oocysts examined for sporulation, (see Table 2).

e. In faecal suspension in 2.5% Pot. dichromate solution:

Same procedure as in III d using 2.5% Potassium dichromate solution (see Table 2).

RESULTS

Analysis of the types of oocysts in 36 faecal samples showed that mixed infections predominate. There were 6 negative specimens, 3 pure infection and 27 mixed infections with combinations of 4—8 species in each case. Oocysts of *Eimeria parva* and *Eimeria arloingi* were found in the pure infection in two and one samples respectively. Of the mixed infections, the combination of oocysts of *E. parva*, *E. nina-kohlvakimovi* and *E. arloingi* occurred more frequently than oocysts of other species encountered in the survey. Four species occur more frequently in this survey and those are *E. parva* (78%); *E. nina-kohlvakimovi* (68%) and *E. crandalis* (44%). Because of their numbers, these four species are likely those causing clinical coccidiosis in goats in Ibadan. *E. arloingi* caused 32% of the total mixed infections while *E. nina-kohlvakimovi* and *E. crandalis* constituted 16% and 7% of infection respectively.

All faecal samples examined were positive for helminth infestations co-existing with the coccidia species.

A summary of the species identified in this survey are contained in Table I. Descriptions of the coccidia species are based on the colour, morphology and dimensions. There are no oocyst residual bodies in the oocysts of the coccidia species affecting goat.

COCCIDIA SPECIES IN NIGERIAN GOATS

TABLE I

Size ranges, sporulation time and morphologic features of the species of *Eimeria* found in Nigerian goats (36 faecal samples analysed)

Species	No. of Oocysts measured	Average size (in Microns)	Sporulation time at room temp. (hours)	Special Features
<i>E. pallida</i>	21	11 × 16	18—24h	Oocysts are small, slender ellipsoidal colourless delicate with plate yellow walls and no polar cap. 3% incidence. Mixed infections.
<i>E. parva</i>	170	14 × 17	18—24h	Small, clear cut colourless crystalline elliptical to sub-spherical in shape with no polar cap. 25% incidence. Both pure and mixed infections.
<i>E. nina-kohlvakimovi</i>	110	17 × 24	24—36h	Brownish yellow, stout, elliptical, capless with thin double contoured wall. 16% incidence. Mixed infections.
<i>E. faurei</i>	41	21 × 29	24—36h	Egg-shaped, brownish, capless oocysts with conspicuous micropyle. 6% incidence. Mix infections.
<i>E. arloingi</i>	218	20 × 28	24—36h	Elongated, ellipsoidal, yellowish-brown oocysts with cap over micropyle. 32% incidence. Both pure & mixed infections.
<i>E. granulosa</i>	20	22 × 30	36—48h	Pyriform, granular, yellowish-brown oocysts with flat cap over the micropyle. 3% incidence. Mixed.
<i>E. crandalis</i>	48	19 × 23U	36—48	Ellipsoidal, yellowish brown oocyst with cap over flat micropylar small end. 7% incidence. Mixed.
<i>E. christenseni</i>	27	24 × 37U	48—56h	Large, ovoid, yellowish-brown oocysts with mound shaped polar cap. 4% incidence. Mixed infection.
<i>E. ahsata</i>	25	26 × 40	60—72h	Very large, ellipsoidal faint pink oocysts with dome-shaped polar cap. 4% incidence. Mixed infection.
<i>Eimeria</i> Species (un-identified)	14	20 × 20U 20 × 22U 24 × 24U Average: 22 × 22U	18—24h	Typically spherical; thick walled with green outer wall, pink inner wall. Sporont fills entire oocyst. No polar cap. Micropyle not seen. Seen in 2 samples only Sporulated within 24 hours.

Sporulation:

Most of the available facts concerning the behaviours of oocysts of ovine (and probably applicable to caprine) are attributable to the work of Lerche (1920). Other investigators namely, Doumes (1921), Carre (1928), Avery Edgar and Christensen (1938) have largely confirmed and expanded the conclusions of Lerche. From the results of these investigators, it is known that the oocysts never sporulate inside the intestine of the host because of the prevailing anaerobic conditions; that oocysts discharged from the host in faecal pellets sporulate within 2—3 days (for most species) provided conditions of temperature, moisture and oxygen tension

are optimum; that excellent conditions for sporulation often occur in the litter and in protected areas in pasture grass; that putrefaction and excessive drying are destructive to oocysts, where as cold retards the rate of sporulation; and finally that infection of a new host takes place through ingestion of feed and drink contaminated with faecal material containing sporulated oocysts.

The present study tries to simulate field conditions under which the oocysts sporulate in Nigeria. Where favourable conditions exist in nature, like in the goat pens under intensive rearing method or the normal shade conditions with adequate temperature and moisture the oocysts will sporulate to infective stages.

ALONGE

TABLE 2

Sporulation of Goat oocysts under various conditions at room temperature (25—27°C)

TIME (HRS)	Trial No.	% Number of undivided oocysts				% Number of intermediate oocysts				% Number of fully developed oocysts			
		36	48	56	144	36	48	56	144	36	48	56	144
Faecal pellets dried in air	1	65				0				35			
	2		9				0				91		
	3			10				70				20	
	4				6				89				5
Faecal pellets under 5mm of top Water	1	80				8				12			
	2		75				12				23		
	3			95				5				0	
	4				89				8				3
Faecal pellets under 5mm of 2.5% Potassium dichromate	1	46				21				33			
	2		61				10				29		
	3			58				36				6	
	4				4				74				22
Faecal suspension in water	1	92				8				0			
	2		58				26				16		
	3			70				30				0	
	4				88				12				0
Faecal suspension in 2.5% Potassium dichromate	1	16				11				75			
	2		9				5				86		
	3			6				40				57	
	4				4				17				79

Observations on the pasture or pens had shown that discharged faecal pellets containing oocysts are subjected to the following conditions:-

1. They fall into running water which was oocysts free from contaminating organic debris.
2. They fall into stagnant water and form a layer of putrefying organic sediment on the bottom, in which the oocysts are lodged.
3. They fall upon the percolate into litter, straw, grass or grain in feed boxes where the oocysts find

favourable conditions of moisture for the preservation of viability for considerable length of time.

4. They fall in open places exposed to the drying action of sunshine and wind.

To simulate the pasture/pen conditions as listed above, first the oocysts were obtained free from the above conditions by taking fresh faecal pellets from goat's colon during slaughter.

A putrefying organic environment was created by placing crushed faecal sediment under water. The result was poor sporulation. The protoplasm in these

COCCIDIA SPECIES IN NIGERIAN GOATS

FIG.1 ABSOLUTE INCIDENCE OF DIFFERENT COCCIDIA SPECIES IN GOAT

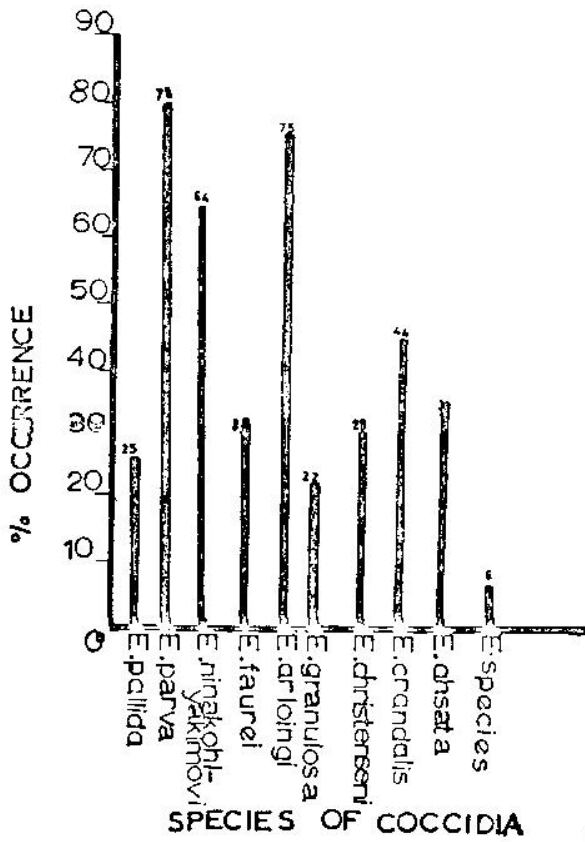


FIG.2 INCIDENCE OF INFECTION OF GOATS WITH DIFFERENT COCCIDIA SPECIES

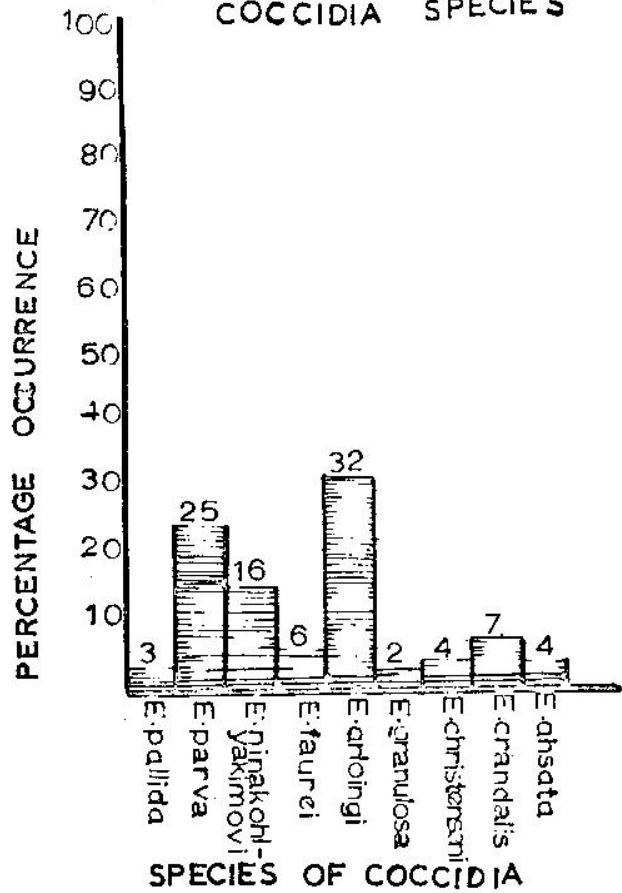
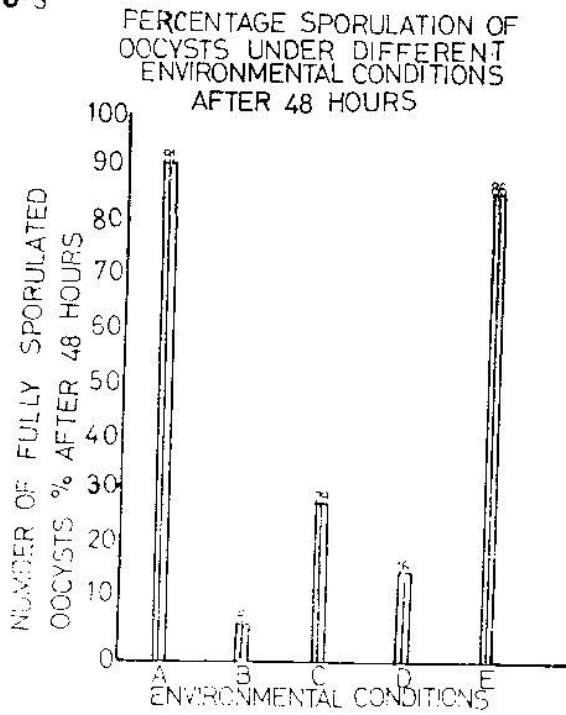


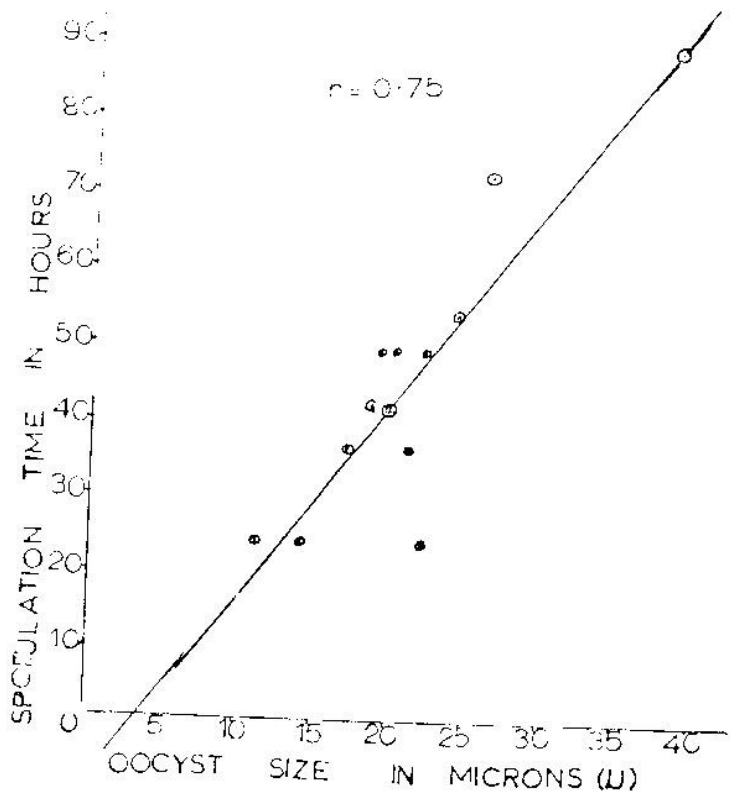
FIG. 3



- A = Oocysts in Dried Faecal Pellets
- B = Oocysts under 5mm of Tap Water
- C = Oocysts under 5mm of 2.5% Pot. Dichromate
- D = Oocysts in Faecal Suspension in Water
- E = Oocysts in Faecal Suspension in 2.5% Pot. Dichromate

FIG. 4

RELATIONSHIP BETWEEN OOCYST SIZE AND SPORULATION TIME



COCCIDIA SPECIES IN NIGERIAN GOATS

oocysts retained the form of spherical sporonts which gradually diminish in size and disintegrated. The absence of sporulation is attributed to oxygen insufficiency resulting from putrefaction rather than to toxic products of the process. The fact that about 16% of the oocysts still sporulate and may remain viable indicates that oocysts may accumulate in wet situations in pasture and survive for many months during the tropical wet season and become infective to susceptible hosts.

The ability of the oocysts to live for long periods in wet situations suggests the advisability of selecting sunny, well-drained terrain for goat lots and pasture. A dry environment was created by drying the faecal pellets in air. The result was an initial sporulation while the moisture inside the pellets was still adequate. As pellets became dry, the oocysts — both unsporulated and sporulated became wrinkled and sporonts were vacuolated and such oocysts cannot infect susceptible hosts. From these, it is clear that drying is fatal to oocysts within several days as a result of loss of water necessary for vital activities of the protoplasm. This observation emphasizes the importance of dry, well-drained land for goat lots and pasture. A control each was run for the above two conditions by incubating the faecal pellets and faecal suspension in 2.5% Potassium dichromate solution.

The result in both cases was an increased percentage sporulation. In the case of the pellets, the 2.5% Potassium dichromate solution provides enough moisture while at the same time, in both cases, all other micro-organisms in the faeces competing with the oocysts for oxygen and other nutrients are killed.

Majority of the coccidia species in goats sporulate between 18—48 hours. This fact can be utilized in goat husbandry to prevent infection. Daily removal of accumulated faecal material in a goat pen will not allow accumulation of sporulated oocysts. Other simple sanitary measures such as frequent changing of bedding,

feeding from racks and elevated troughs rather than off the ground reduces the chances of feed being contaminated with sporulated oocysts. Sporulation time of oocysts is directly proportional to the size. The larger the oocyst, the more time it takes to sporulate as shown in figure 4, in which the coefficient of correlation is 0.75 and is highly significant.

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ALONGE

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