Diversity and seasonal occurrence of *Eimeria* species in a mixed flock of communally reared sheep and goats in Mafikeng in the North West Province, South Africa

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ABSTRACT

Diversity and seasonal occurrence of coccidia in a communally reared mixed flock of sheep and goats at Mafikeng, North West Province, South Africa, was determined between March 2008 and February 2009. Faecal specimens were collected directly from the rectum of the animals and the number of oocysts per gram of faeces (opg) determined. The mean monthly opg for goats was significantly higher than that for sheep. Higher oocyst counts were observed during the hot, rainy season than during the cold, dry season. The highest mean values for both the sheep (862.5 opg) and goats (1200 opg) were recorded during March. Six species (*Eimeria crandallis, E. bakuensis, E. weybridgensis, E. ahsata, E. intricata,* and *E. ovinoidalis)* were recovered from sheep, with *E. crandallis and E. bakuensis* occurring most frequently. The last 2 species, together with *E. ahsata,* are considered among the most pathogenic species in sheep. In goats, 7 species (*E. arloingi, E. jolchijevi, E. caprina, E. alijevi, E. caprovina, E. christenseni and E. hirci*) were recovered, with *E. arloingi and E. jolchijevi* occurring most frequently. Up to 5 *Eimeria* species were recovered from individual specimens in goats while up to 4 were recovered in sheep. No cross-infections between goats and sheep were recorded and no clinical coccidiosis was noted during the study. It is increasingly becoming evident that the pathogenic *E. arloingi* is one of the most commonly occurring *Eimeria* species in goats in South Africa.

Keywords: communal sheep, diversity, *Eimeria* species, goats, seasonal occurrence.

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INTRODUCTION

Coccidiosis in small ruminants, caused by host-specific *Eimeria* species[10], is of economic and medical importance. Infections of sheep and goats, involving both normal and diseased individuals[5,9,22], have been observed in almost all rearing systems worldwide. Clinical coccidiosis is a major contributor to enteric disease of sheep and goats, occurs mainly in young animals, and has higher prevalence under conditions of intensive husbandry and various stress factors[3,20]. Even though coccidiosis may prove fatal, its greater economic importance lies in the unthriftiness and lowered productivity that it causes[17]. Fifteen and 16 *Eimeria* species have been described from sheep and goats, respectively[15,20]. Knowledge of the prevalence of *Eimeria* species in a flock helps to minimise economic losses, and to evaluate infection potential and control programmes[24]. Coccidial infections of small stock have been reported from several African countries, including Botswana[14], Kenya[7,11], Nigeria[23], South Africa[5,6], Tanzania[9] and Zimbabwe[2]. Except for a few reports[5,6,16], there is a general paucity of information on the species and prevalence of coccidiosis in sheep and goats in South Africa, however, more so the communally reared ones. The objectives of this study were therefore to determine the diversity and seasonal occurrence of coccidial oocysts in a communal, mixed flock of sheep and goats in Mafikeng.

MATERIALS AND METHODS

The study was conducted at the North West University teaching farm in Mafikeng (25°49′S, 25°36′E), in the North West Province of South Africa from March 2008 to February 2009. Mafikeng has a typical semi-arid savanna climate, with a long dry season extending from May to October. The mean monthly minimum temperatures vary from 2.7 °C in July to 17.7 °C in January, while mean maximum temperatures vary from 20.7 °C in June to 30.6 °C in December. The mean monthly meteorological data for Mafikeng over the last 18 years are presented in Fig. 1.

Thirty-two each of adult (>1 year) Dorper sheep and Boer goats were used in this study. The animals were housed together in a partially roofed enclosure (15 × 15 m) that had a dirt floor. The animals were kraaled at night and let out by day to graze on communal rangelands where they mixed freely with indigenous goats, sheep and cattle.

Faecal samples from goats and sheep

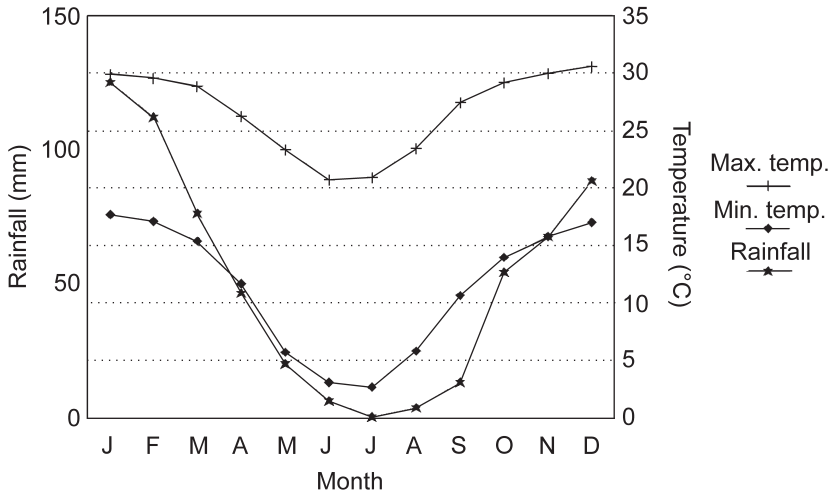

Fig. 1: **Average rainfall** (mm) **and temperature** (°C) **data for Mafikeng over 18 years.**

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were collected directly from the rectum of the animals at monthly intervals. The faecal samples were transported to the laboratory on ice and if not analysed immediately were stored at 4 °C. The modified McMaster technique was performed to determined the number of oocysts per gram (opg) of faeces[18]. For species identification, faecal samples were collected directly from the rectum of 10 each of sheep and goats, and immediately sent to the laboratory for processing. At the laboratory, the samples were allowed to sporulate, after which they were processed and species identification performed as previously described[6].

RESULTS

Over the 12-month period, 768 faecal specimens were collected, 384 from sheep and 384 from goats. Six species, namely *E. crandallis* (100 %), *E. bakuensis* (100 %), *E. weybridgensis* (60 %), *E. ahsata* (40 %), *E. intricata* (20 %) and *E. ovinoidalis* (20 %) were recovered from the sheep. Seven species were recovered from goats, namely *E. arloingi* (80 %), *E. jolchijevi* (80 %), *E. caprina* (40 %), *E. alijevi* (40 %), *E. christenseni* (20 %), *E. caprovina* (20 %) and *E. hirci* (20 %). Up to 5 *Eimeria* species were recovered from individual specimens in goats, while up to 4 were recovered from sheep. No cross-infections between goats and sheep were recorded.

Overall mean opg counts in sheep and goats were 544 and 774, respectively (Table 1). Statistical analysis revealed significantly ($P < 0.05$) higher levels in goats than in sheep. The highest individual count for sheep was 9000 opg, compared to 13 200 opg for goats. Except for the preiod August–October 2008, when opg counts were generally low, monthly mean opg counts for goats were significantly ($P < 0.005$) higher than those of sheep. In both sheep and goats, the opg counts followed a seasonal pattern. Opg decreased from March till August and remained low until October. Counts then started rising gradually until February (Table 1). The lowest mean values for sheep (263 opg) and goats (375 opg) were recorded in June and October, respectively, while the highest mean counts for both species were recorded in March, at 863 opg and 1200 opg, respectively. No evidence of clinical coccidiosis was noted during the study.

Table 1: **Mean monthly oocysts per gram of faeces counts and standard error of the mean** (SEM) **for sheep and goats.**

Months	Sheep Mean ± SEM	Goats Mean ± SEM
Mar 2008	862.5[a] ± 119.3	1200.0[b] ± 127.8
Apr 2008	575.0[a] ± 062.9	887.5[b] ± 125.1
May 2008	387.5[a] ± 053.1	987.5[b] ± 128.4
Jun 2008	262.5[a] ± 030.1	550.0[b] ± 071.8
Jul 2008	412.5[a] ± 053.1	587.5[b] ± 076.3
Aug 2008	437.5[a] ± 055.4	400.0[a] ± 063.2
Sep 2008	400.0[a] ± 054.7	393.5[a] ± 062.2
Oct 2008	375.0[a] ± 054.3	375.0[a] ± 051.2
Nov 2008	525.0[a] ± 068.0	775.0[b] ± 085.3
Dec 2008	625.0[a] ± 070.4	975.0[b] ± 099.7
Jan 2009	812.5[a] ± 111.7	1062.5[b] ± 123.4
Feb 2009	850.0[a] ± 199.0	1100.0[b] ± 123.8
Mean (opg)	543.7	774.4

[a,b]Means with the same letter in a row are not significantly different ($P > 0.05$).

DISCUSSION

Six and 7 *Eimeria* species were recovered from sheep and goats, respectively, with no cross-infections occurring. This was not surprising since *Eimeria* species are known to be host specific[10]. Fifteen and 16 species of *Eimeria* have been recorded in sheep and goats, respectively[4,20], of which 6 and 7 species, respectively, were identified in this study. The most frequently occurring species in sheep were *E. crandallis* and *E. bakuensis,* which together with *E. ahsata,* are also the most pathogenic species in sheep[8,19]. This implies higher risk of coccidiosis in sheep around Mafikeng when other predisposing factors exist. In a study on coccidiosis of sheep on commercial farms in South Africa[16], an additional 3 species to those identified around Mafikeng, namely *E. parva, E. faurei,* and *E. granulosa* were identified. The current results also compare well with those recorded in Tanzania[9] and Jordan[1], with most of the species being similar. In goats, 7 species were identified, with *E. arloingi* and *E. jolchijevi* being the most frequently occurring. *Eimeria arloingi* is regarded as one of the most pathogenic species in goats together with *E. christenseni* and *E. ninakohlyakimovae*[10,13], again indicating the possible high risks for goats around Mafikeng. In a similar study in an area about 300 km east of Mafikeng, *E. arloingi* was also the most frequently occurring species followed by *E. hirci,* which occurred less frequently in this study[6]. Another study in South Africa identified all the species in the current study except *E. caprovina*[16]. Based on the current study and others conducted in South Africa[6,16], it appears *E. arloingi* is among the most commonly occurring *Eimeria* species of goats in South Africa.

Sheep excreted significantly fewer oocysts than goats in this study. This was in agreement with studies in Kenya, other parts of South Africa and Tanzania, where the mean opg counts for goats were higher than those of sheep[5,9,11]. In both sheep and goats, higher oocyst counts were observed during the months of January to March, peaking in March (Table 1), most likely owing to the heavy rains and higher temperatures which occur in these months (Fig. 1) that favour oocyst sporulation[18,21]. A study performed in southern Botswana, however, revealed no obvious seasonal patterns in the faecal levels of coccidial oocysts in goats[14].

No evidence of clinical coccidiosis was found in this study. Previous studies have shown that *Eimeria* oocysts are widely present in the faeces of both normal and diseased individuals[9].

In conclusion, goats had higher oocyst counts than sheep, while the highest counts for both species of small stock occurred during the hot, wet season than during the dry, cold season. Six different species of *Eimeria* were recovered from sheep, while 7 species were recovered from goats. Up to 5 *Eimeria* species were recovered from individual specimens in goats while up to 4 were recovered in sheep. No cross-infections between goats and sheep were recorded for all *Eimeria* species. It is increasingly becoming evident that *E. arloingi* is one of the most common *Eimeria* species in goats in South Africa.

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