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Technical note

Laboratory diagnosis of novel species of *Theileria hirci*, *Eimeria caprovina* and *Eimeria pallida* in goats in Iraq

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Abstract

Laboratory examination of blood smears and fecal samples collected from 615 goats around Baghdad city revealed positive cases of *Theileria hirci* (208), *Eimeria caprovina* (94) and *Eimeria pallida* (48). These protozoa are novel species and have not been previously reported in Iraq.

Keywords: Goats; *Theileria hirci*; *Eimeria caprovina*; *Eimeria pallida*; Iraq

1. Introduction

Theileriosis is one of the important diseases of farm animals in Iraq. In sheep, Little Wood (1915) reported the causative agent to be *Theileria hirci*. In cows, Machattie (1935) mentioned that the causative agent was *T. anulata*. In goats, theileriosis has only been suspected clinically by veterinarians without laboratory confirmation.

Mirza (1970) identified the following seven species of *Eimeria* in goats in Iraq: *E. crandalis* (*E. hirci*), *E. christenseni*, *E. parva* (*E. alijeri*), *E. fauri* (*E. apsheronica*), *E. ninakoholyakimovae*, *E. arlongi* and *E. granulosa* (*E. jolchijevi*).

The present investigation was carried out to identify some non-reported protozoa of goats in Iraq.

2. Materials and methods

Blood smears and fecal samples were collected randomly from 615 goats around Baghdad city (north, south, east, west) and from IPA station for goat breeding.

Blood smears were stained with Giemsa and examined under the oil-immersion lens (Adam et al., 1971). The parasitemia was calculated according to Schalm et al. (1975). Fecal sample of about 3–5 g were well mixed and filtered through four fold gauze, then treated with Sheather's sugar solution according to Dunn (1969).

3. Results

Microscopic examination of the 615 stained blood smear's for *T. hirci* revealed 208 (33.82%) positive cases, while examination of the 615 fecal samples

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Table 1
Number and percentage positive of *T. hirci*, *E. caprovina* and *E. pallida*

Protozoan	Number of positive animals	%
T. hirci	208	33.82
E. caprovina	94	15.28
E. pallida	48	7.8

revealed 94 (15.28%) and 48 (7.8%) positive cases for *E. caprovina* and *E. pallida* (Table 1).

The distribution of the positive cases for *T. hirci*, *E. caprovina* and *E. pallida* according to the directions and IPA station are shown in Table 2. *E. caprovina* and *E. pallida* descriptions of the oocysts are mentioned in Table 3. *T. hirci* was seen in many forms in blood smears. Fig. 1 shows *T. hirci* inside a red blood cell, while Figs. 2 and 3 show respectively the microschizonts and macroschizonts in the cytoplasm of a lymphocyte.

4. Discussion

T. hirci infection in general was 33.82% and according to the direction and IPA station, it ranged between 8.17 and 31.13%. These results are similar to Luo and

Table 2
Distribution of positive cases according to the directions and IPA station

Protozoan	North	South	East	West	IPA station	Total
T. hirci	17 (8.17%)	40 (19.23%)	66 (31.73%)	32 (15.38%)	53 (25.48%)	208
E. caprovina	10 (10.6%)	13 (13.8%)	33 (35.1%)	11 (11.7%)	27 (28.72%)	94
E. pallida	10 (20.83%)	14 (29.16%)	4 (8.3%)	9 (18.75%)	11 (22.91%)	48

Table 3
Description of *E. caprovina* and *E. pallida* oocysts in goats

Protozoan	Shape	Size (μm)	Micropyle	Micropolar cup	External layer of oocyst wall
E. caprovina	Broad oval or ellipsoidal	*L*: 27.72 (26.4–31.35), *W*: 22.4 (19.8–24.75)	Present	Not present	Colorless
E. pallida	Oval or ellipsoidal	*L*: 17.32 (16.5–18.5), *W*: 13.5 (13–14)	Present (±)	Not present	Pale yellow, green or colorless

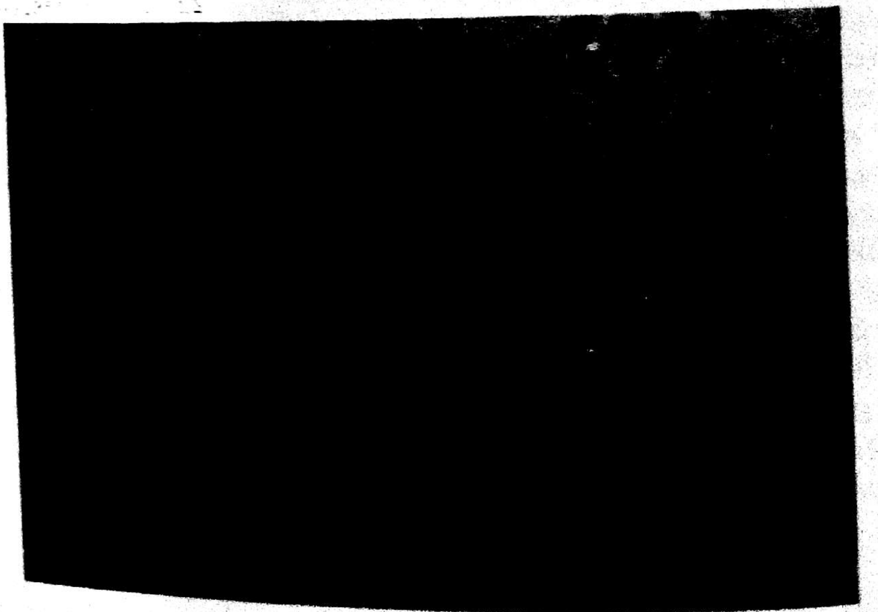

Fig. 1. *T. hirci* inside a red blood cell in a blood smear of a goat (1000×).

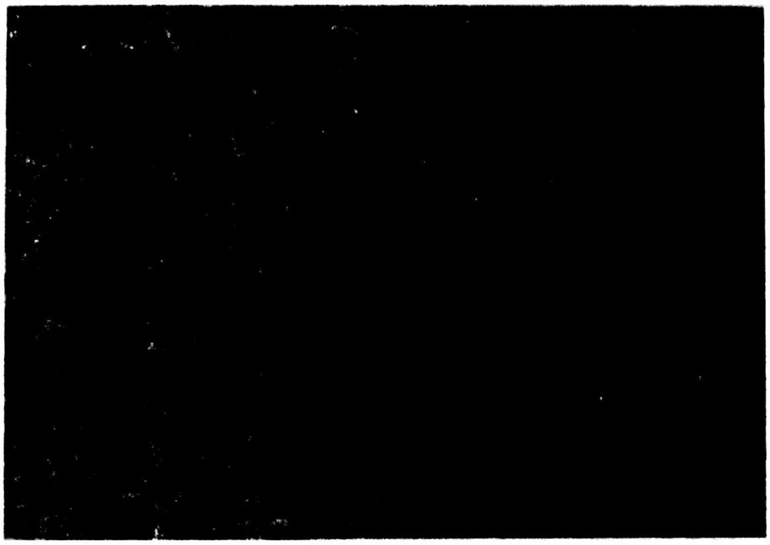

Fig. 2. Microschizonts of *T. hirci* inside a lymphocyte in a blood smear of a goat (1000×).

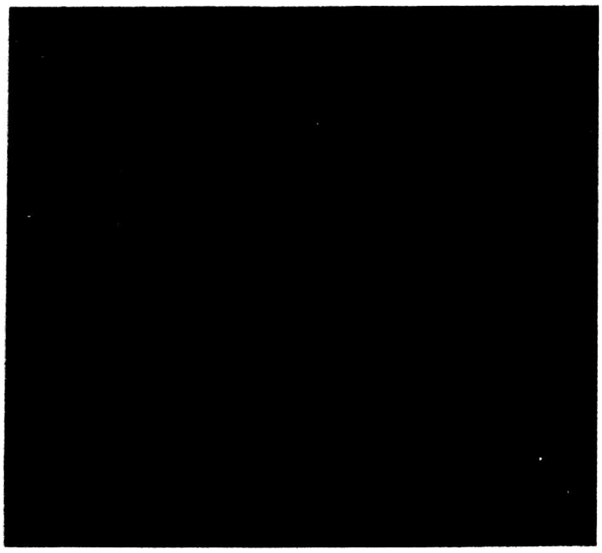

Fig. 3. Macroschizonts of *T. hirci* inside a lymphocyte in a blood smear of a goat (1000×).

Yin (1997) in China who found *T. hirci* infection in goats between 8.06 and 40%. Most positive cases of *T. hirci* of this investigation were apparently healthy. A single case showed enlargement of prescapular lymph nodes, pale conjunctiva, with (16%) parasitemia. Such finding is in accordance with Sasmal et al. (1983), who observed clinical signs of theileriosis in goats along with high parasitemias ranging between 18.25 and 31.36%. The shapes of *T. hirci* in examined blood smears were similar to Neitz (1957).

The 15–28% of *E. caprovina* infection of this investigation lies within the ranges mentioned by Norton (1986), O'callaghan (1989), Penzhorn et al. (1994), Kusiluka et al. (1996) Koudela and Bokova (1998) and Jalila et al. (1998) (4, 12, 29.4, 16, 6 and 12%, respectively). The description of the oocyst was similar to Lima (1980).

E. pallida infection of 7.8% is within the percentage ranges mentioned by Chhabra and Pandey (1991) and Jalila et al. (1998) (6.2 and 4%, respectively), while Woji et al. (1994) reported an infection percentage of 22%. The description of the oocyst was similar to Christensen (1938).

5. Conclusion

Due to the natural resistance of goats to infection by *T. hirci*, high parasitemias are required for obvious clinical signs.

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