



Prevalence of *Theileria* spp. infection in sheep in South Khorasan province, Iran

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Abstract

The prevalence of *Theileria* spp. infection was studied in sheep in the South Khorasan province in Iran from 2003 to 2004. A total of 840 sheep from 34 flocks were clinically examined and investigated for the presence of *Theileria* spp. in the appropriate blood smears and any tick species on the body of the animals. In this study, 11.9% of sheep were infected with *Theileria* spp., with a parasitemia of 0.02–0.1%. Differences in the infection rates were statistically significant among different areas of the South Khorasan province. The highest prevalence was found in the Ferdows area (31.4%) and the lowest rate in the Nehbandan area (0.7%). The prevalence of *Theileria* spp. infection in males and females and between different age groups of sheep were not statistically significant. Seasonally, the prevalence of *Theileria* spp. infection in sheep reached its highest level in June (26.3%), whereas it decreased in July and August. It was found that 50.5% of the animals harbored *Rhipicephalus sanguineus*, 48.5% harboured *Hyalomma anatolicum* and 0.89% harboured *Hyalomma dromedari*.

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1. Introduction

Theileria infection in small ruminants is due to the presence of at least four parasitic species. *Theileria lestoquardi* is a highly pathogenic parasite of sheep and goats. Non-pathogenic or mildly pathogenic *Theileria* spp. of small ruminants include *Theileria separata*, *Theileria ovis* and *Theileria recondita*.

However, there is considerable confusion in the taxonomy of non-pathogenic theileriasis of small ruminants (Uilenberg, 1995). According to Hashemi-Fesharaki (1997), two species of *T. lestoquardi* and *T. ovis* cause ovine theileriosis in Iran. *T. lestoquardi*, which is a causal agent of malignant sheep and goat theileriosis (Hooshmand-Rad and Hawa, 1973a) was more highly reported from the south and south-east of Iran (Hashemi-Fesharaki, 1997; Razmi et al., 2003a). According to Hashemi-Fesharaki (1997), *T. ovis* is widespread throughout the country. However, there is no epidemiological study about this species. Indeed,

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the epidemiological aspects of ovine theileriosis are poorly understood and further investigations in Iran are required. The climate of the South Khorasan province is similar to other areas in Iran where ovine theileriosis is seen. In addition, many suspected cases of ovine theileriosis have been reported by local veterinary services in this area. The aim of the present study was to determine the prevalence and distribution of ovine theileriosis in the South Khorasan province. In addition, special attention was given to the determination of the distribution of tick species in sheep flocks.

2. Materials and methods

2.1. Field study area

The study was carried out in the South Khorasan province, which is located in the east of Iran (Fig. 1). An average population of 1,493,838 sheep was distributed in this area. Sheep husbandry is one of the most economically important occupations in this area. Sheep and goats are kept together and the average herd population is 200–1000 heads. The sheep outnumbered goats and the distribution was 50–900 sheep and 30–200 goats in each flock. The climate of the area is semi-arid, with cold winters and warm summers and an average annual rainfall of 167 mm. The mean annual temperature ranges from 5.5 to 23 °C.

2.2. Sample size

The prevalence of *Theileria* infection in the South Khorasan province was estimated to be 10% (Eshrati, 2002). Therefore, the desired sample size was 140 sheep, with a confidence level of 95%. Twenty-five animals were randomly sampled from each flock to detect the presence of infection (Thrusfield, 1997). Sheep flocks were randomly selected by the local veterinary service of each area using a random numbers table.

2.3. Experimental procedure

Each flock was visited once during 2003 and once during 2004. First, 25 sheep from each flock were randomly selected. The selected animals were

clinically examined and blood smears were prepared from the marginal ear veins; the bodies of the animals were examined for ticks and, if present, they were collected for identification.

2.4. Examination of blood smears

The smears were air-dried, fixed in methanol and stained in 10% Giemsa solution in phosphate-buffered saline (PBS) with a pH of 7.2. The slides were examined with an oil immersion lens with a magnification of 1000×. The full length of the intraerythrocytic mature *Theileria* organism was measured by a graded ocular microscope with a magnification of 1000×. Parasitemia was assessed by counting the number of infected red blood cells by examination of 100 microscopic fields (approximately 100,000 cells). The number of infected cells was then expressed as a percentage.

2.5. Examination of ticks

Collected ticks from infested sheep were counted and speciation was carried out using the identification keys of Hoogstraal (1956), Kaiser and Hoogstraal (1963) and Mazlum (1972).

2.6. Statistical analysis

The results of the present study were analyzed using Chi-square test. A *P*-value less than 0.05 was considered significant.

3. Results

Of 840 sheep examined, 100 (11.9%) were infected with *Theileria* spp. and 361 (43%) had a tick infestation. None of the infected sheep showed any clinical signs of theileriosis. The *Theileria* spp. were observed in ring, oval and rod forms, with a size of 0.5–1.5 μm. The parasitemia rate ranged from 0.02 to 0.1% in the infected sheep. Among the different areas of the South Khorasan province, the highest prevalence was found in the Ferdows area (31.4%) and the lowest rate in the Nehbandan area (0.7%) (Table 1) ($P < 0.0001$). The prevalence of *Theileria* spp. infection in all age groups and between male and female sheep was not significantly different. The

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