

The Blood Parasites of Indigenous Livestock in Saudi Arabia*

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ABSTRACT. The blood parasites of indigenous camels, sheep, goats and cattle were investigated in several localities in Saudi Arabia that are well isolated from any possible mixing with imported animals. The present study is the first detailed investigation on blood parasites infecting indigenous livestock in Saudi Arabia. *Trypanosoma evansi* and an *Eperythrozoon* sp. were detected in camels. Sheep and goats were infected with *Theileria ovis*, *Theileria hirci* and with *Eperythrozoon ovis* and cattle with *Eperythrozoon wenyoni*, *Theileria annulata* and with a nonpathogenic *Theileria* sp. Apart from *T. evansi* and *T. annulata*, all parasite species are reported for the first time from Saudi Arabia. The detection of an *Eperythrozoon* sp. form the camel is the first from this host. *Theileria ovis* and *E. ovis* were reported from all provinces examined, while *T. hirci* was confined to eastern and northern parts of the Kingdom. *Eperythrozoon wenyoni* was found in both of Hofuf and Gizan, but *T. annulata* occurred in Hofuf only and the nonpathogenic *Theileria* sp. in Gizan only. Areas of highest camel trypanosomiasis prevalence were heavily infested with tabanid flies whose role in the transmission of the disease was discussed. The pathological effects of the reported blood parasites on their hosts was discussed together with the role of ixodid ticks in the transmission of the *Theileria* species

Blood parasites are of great importance to farm animals as they are often the agents of serious diseases (Purnell 1981 and Boid *et al.* 1985) and often of high mortality rates, too (Soulsby 1982). Hence several models have been established in many laboratories, including ours, for the study of these parasites and rodent babesiosis is the most used of these models (Phillips 1969, Nowell 1969, Young and Cox 1971, Hussein 1973, 1979, 1984, 1990, and Abdalla *et al.* 1978a,b).

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Nevertheless, studies on these parasites in Saudi Arabia are virtually non-existing and even *Trypanosoma evansi* the first trypanosome proven to be pathogenic to mammals (Evans 1880), was only recently confirmed in the Kingdom (Kasim 1984).

The present study is complementary to previous investigations carried out between 1981 and 1987 to identify the indigenous tick species infesting local livestock in Saudi Arabia (Al-Khalifa *et al.* 1987, Diab *et al.* 1987, and Hussein *et al.* 1988). Together with these studies undertaken throughout the Kingdom, the blood parasites infecting indigenous farm animals were investigated.

Materials and Methods

Random, wet and thin dry, ear vein blood smears, as well as, lymphnode puncture smears were obtained from at least 10 camels, 10 sheep and 10 goats from flocks and herds of indigenous animals at the sites shown in Fig. 1. These sites were within a radius of at least 100 km around each of the urban centres (1-24) shown in Fig. 1. The animals sampled were born and bred there and totally isolated from imported livestock (Al-Khalifa *et al.* 1987, Diab *et al.* 1987, and Hussein *et al.* 1988). Wet blood smears were immediately examined in the field using a field light microscope (Wild 11, Switzerland). Heparinized microhaematocrit tubes (Fisher Scientific Company, Pennsylvania, USA) were also filled with ear vein blood from these animals and examined in the field for trypanosomes using the method of Kelley and Schillinger (1983). The thin blood smears and the lymphnode puncture smears were air-dried, fixed with absolute methanol and transported to the laboratory in plastic or wooden slide boxes. Indigenous cattle at the localities of Hofuf, Eastern Province and Gizan, Gazan Province (Fig. 1) were similarly investigated.

Moreover, Najdi camels slaughtered for human consumption at Riyadh Central Abattoir were investigated, too. Just before slaughter, blood was drawn from the jugular vein of each of 135 Najdi camels into sterile, EDTA-coated vacutainers (Becton-Dickson, New Jersey, USA) and carried to the laboratory.

In the laboratory, the thin blood smears and the lymphnode puncture smears were stained with Giemsa's stain and examined for blood parasites. The blood of Najdi camels obtained from Riyadh Central Abattoir was examined for trypanosomes by the microhaematocrit centrifuge technique (MHCT) developed and improved by Woo (1969, 1970, 1974). Blood from some of the positive samples was also inoculated into Balb/c mice for parasite isolation.

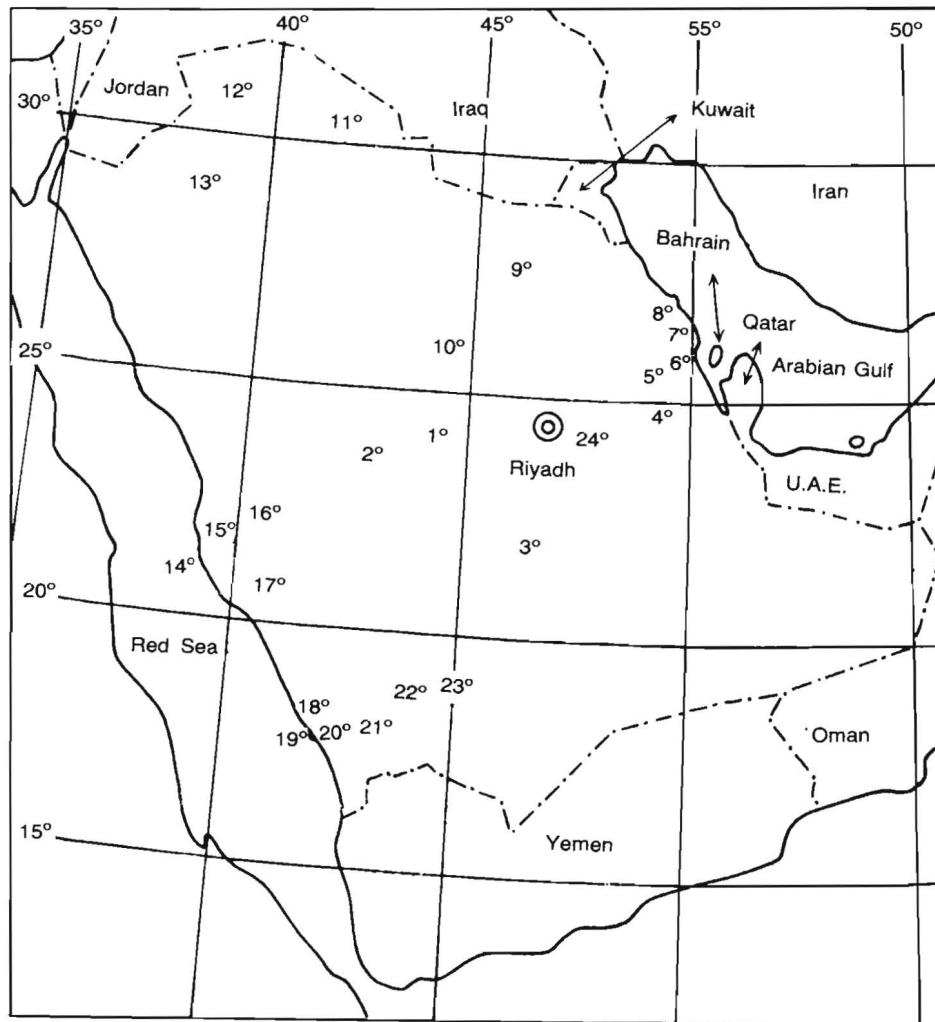


Fig. 1. Map of Saudi Arabia showing urban centres (all cities in the map except Riyadh) where blood was collect from indigenous livestock at a radius of about 100 km around each centre. 1, Al-Dawadmi; 2, Afif; 3, Layla; 4, Hofuf; 5, Abqauq; 6, Al-Thuqba; 7, Dammam; 8, Al-Qatif; 9, Al-Hafir, 10: Buraydah; 11, Arar; 12, Turayf; 13, Al-Qurayat; 14, Makkah; 15, Al-Sharayia; 16, Al-Taif; 18, Sabia; 19, Gizan; 20, Samitah; 21, Al-Darb; 22, Najran; 23, Khibash; 24, Al-Kharj.

Results

During the study, a total of 310 camels, 331 sheep and 348 goats were examined (Table 1) together with 25 and 18 cows from Gizan and Hofuf, respectively. The camels were infected with *T. evansi* (13.2%) as well as with an *Eperythrozoon* sp. (3.9%) and the sheep and goats with *Theileria ovis* Rodhain, 1916 (19.9%), *Theileria hirci* Dschunkowsky and Urodshevich, 1924 (6.9%) and *Eperythrozoon ovis* Neitz, Alexander and duToit, 1934 (3%, Table 1). Differentiation between *T. hirci* and *T. ovis* was made on the basis of prevalence in the former and scarcity or absence from the latter of Koch's blue bodies (Fig. 2) as indicated by Neitz (1956) and Uilenberg (1981). In *T. hirci* infections, these schizonts were prevalent in both of lymphnode puncture and blood smears and

Table 1. Blood parasites of indigenous farm animals in Saudi Arabia

Province: Locality		Blood parasites detected							
		Camel		Sheep			Goats		
		<i>T.evansi</i>	<i>Eperythrozoon</i> sp.	<i>T.ovis</i>	<i>T.hirci</i>	<i>E.ovis</i>	<i>T.ovis</i>	<i>T.hirci</i>	<i>E.ovis</i>
Riyadh:	Dawadmi	1/15	0/15	3/15	0/15	0/15	3/15	1/15	0/15
	Afif	1/10	0/10	1/10	0/10	0/10	1/10	0/10	0/10
	Al-Kharj	4/18	2/18	5/17	4/17	2/17	4/15	3/15	1/15
	Layla	0/10	0/10	2/15	0/15	0/15	3/15	0/15	0/15
Infection rate %		11.3	4.3	19.3	7	3.5	20	7.3	1.8
Eastern:	Hofuf	6/16	2/16	4/15	3/15	2/15	6/15	4/15	1/15
	Abqauq	2/10	0/10	3/10	1/10	0/10	4/15	2/15	0/15
	Al-Thuqba	1/10	0/10	2/10	0/10	0/10	3/15	2/15	1/15
	Dammam	1/10	0/10	2/10	1/10	0/10	2/10	1/10	0/10
	Al-Qatif	0/10	0/10	2/10	1/10	1/10	3/15	2/15	0/15
	Al-Hafr	3/18	0/18	3/15	1/15	0/15	6/15	4/15	1/15
Infection rate %		17.6	2.9	22.9	10	4.3	28.2	17.7	3.5
Qasim:	Buraydah	3/18	1/18	3/15	1/15	1/15	6/15	2/15	1/15
Infection rate %		16.7	5.6	20	6.7	6.7	40	13.3	6.7
Northern: Frontier:	Arar	1/15	0/15	5/15	3/15	1/15	4/15	2/15	0/15
	Turayf	1/15	1/15	3/15	2/15	0/15	2/15	2/15	1/15
	Qurayat	1/10	0/10	3/10	2/10	0/10	3/10	3/10	0/10
Infection rate %		7.5	2.5	27.5	17.5	2.5	22.5	17.5	2.5

here sometimes even extracellularly (Fig. 2a). Moreover, intraerythrocytic forms were common. Several of these animals were very sick and many had enlarged prescapular and prefemoral lymphnodes. On the other hand, schizonts were not detected in any of the animals infected with *T. ovis*. All were healthy looking and only rarely erythrocytic forms were detected in their blood smears.

The *Eperythrozoon* infection rate was very low in all animals examined and there were no concurrent infections with any of the other parasites detected in any of the animals examined. Gazan Province showed the highest prevalence rates of blood parasite infections, but *T. hirci* was absent from this province. The next highest prevalence rate was found in the Eastern Province where the incidence of

Table 1. continued

Province: Locality		Blood parasites detected							
		Camel		Sheep			Goats		
		<i>T.evansi</i>	<i>Eperythrozoon</i> sp.	<i>T.ovis</i>	<i>T.hirci</i>	<i>E.ovis</i>	<i>T.ovis</i>	<i>T.hirci</i>	<i>E.ovis</i>
Makkah:	Makkah	0/10	0/10	0/15	0/15	1/15	0/15	0/15	0/15
	Al-Sharayia	1/10	1/10	1/15	0/15	1/15	1/15	0/15	0/15
	Al-Sayl	0/10	0/10	0/15	0/15	0/15	0/15	0/15	0/15
	Al-Taif	0/10	0/10	0/15	0/15	0/15	0/15	0/15	1/15
Infection rate %		5	2.5	1.7	0	3.3	1.7	0	1.7
Gazan:	Sabia	2/15	0/15	4/15	0/15	0/15	2/15	0/15	1/15
	Gizan	6/15	3/15	7/15	0/15	1/15	4/15	0/15	0/15
	Samitah	3/15	1/15	3/15	0/15	0/15	3/15	0/15	0/15
	Al-Darb	0/15	0/15	3/15	0/15	0/15	3/15	0/15	1/15
Infection rate %		18.3	6.7	28.3	0	1.7	20	0	3.3
Najran:	Najran	3/15	1/15	3/15	0/15	1/15	2/15	0/15	0/15
	Khibash	0/10	0/10	2/12	0/12	0/12	4/18	0/18	1/18
Infection rate %		12	4	18.5	0	3.7	18.2	0	3
Total & overall		41/310	12/310	64/331	19/331	11/331	69/348	28/348	9/348
Infection rate %		13.2	3.9	19.3	5.7	3.3	19.8	8.1	2.6
Overall incidence of sheep and goat parasite infections			<i>T.ovis</i> : 133/679 19.9%		<i>T.hirci</i> : 47/679 6.9%		<i>E.ovis</i> : 20/679 3%		

Numerator is number infected, denominator is number examined.

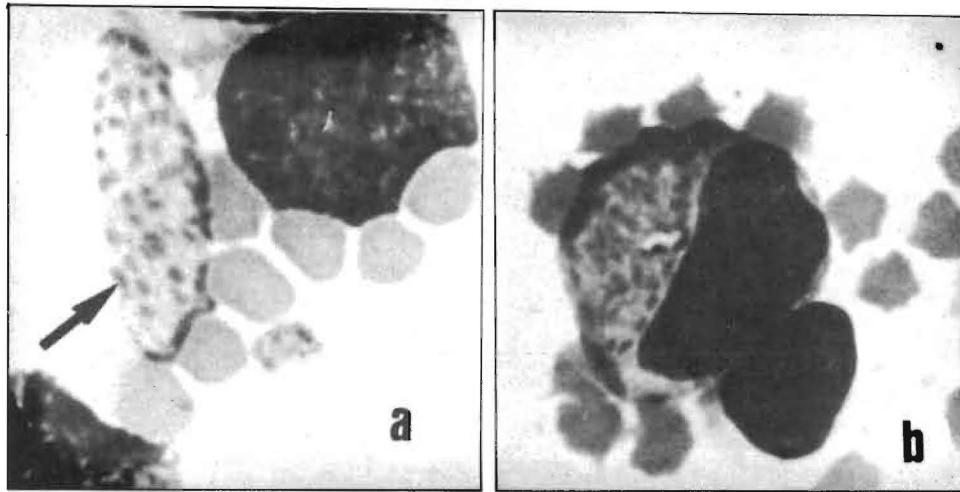


Fig. 2. Koch's blue bodies in lymphnode puncture smears from a goat infected with *Theileria hirci*, a, extracellular schizont (arrow); b, intracellular schizont in a lymphocyte (x 1600).

T. hirci infection was the highest in the country. The lowest prevalence rate of blood parasite infections was in Makkah Province, and *T. hirci* was not recorded there too (Table 1.) On the other hand, camel trypanosomiasis was most common in Gazan and the Eastern Provinces, where the infection was especially high around Gizan (40%) and Hofuf (37.5%). The infection was also high in camels sampled at Al-Kharj (22.2%), Samitah and Najran (20% in each) and Al-Hafr and Buraydah (16.7% in each, Fig. 1, Table 1). Many tabanid flies were observed feeding on camels in these areas of high camel trypanosomiasis prevalence. The flies were very aggressive and caused great annoyance and worry to the camels. They inflicted wounds bleeding for some time and rarely they fed to repletion on a single camel, as they were driven away by the camel due to its pain. One fly was once sighted biting up to 7 camels before repletion. Several flies were collected from these localities with an entomological net. Those collected from Hofuf, Al-Hafr, Al-Kharj and Buraydah belonged to a single species, *Atylotus farinosus* (Sziley 1915) and those from Gizan, Samitah and Najran belonged to a single species, too, *Atylotus agrestis* (Wiedmann 1828), Tabanid flies were rarely observed in any of the other localities examined.

The most common and widespread blood parasite was *T. ovis* (19.9%) which was recorded from all provinces although, in Makkah Province only a single ewe and a single goat, both at Al-Sharayia, were infected (Table 1). On the other hand, *T. hirci* infection seems to be confined to eastern and northern parts of the

Kingdom. The infection was not recorded in any of the animals sampled in Makkah, Gazan and Najran Provinces. Moreover, apart from Al-Kharj region in the eastern part of Riyadh Province, none of the animals sampled in western (Al-Dawadmi and Afif) and southern (Layla) parts of the province (Fig. 1), were infected with this parasite (Table 1).

Cattle were only examined at Hofuf and Gizan as they are the only areas in the Kingdom with a considerable indigenous cattle population, although most of the animals in Hofuf were actually crosses of local and European breeds. Nine of the 18 (50%) cows at Hofuf were infected with *Theileria annulata* Dschunkowsky and Lush, 1904 (Fig. 3); 4 of these had a high parasitaemia with fever and congested conjunctival capillaries. Their mucous membranes were icteric and their superficial lymphnodes were enlarged. Koch's blue bodies were prevalent both in lymphnodes puncture and blood smears, both intracellularly and extracellularly. One of the 4 cows was recumbent and was in a serious condition. On the other hand, 6 of the 25 cows (24%) sampled at Gizan were infected with a seemingly nonpathogenic *Theileria* sp. that produced scarce erythrocytic forms (Fig. 4) and schizonts were not detected neither in lymphnode puncture nor blood smears. All of the 6 cows looked healthy and showed no signs of disease. Moreover, 3 and 5 of the other cows examined at Hofuf and Gizan, respectively were infected with *Eperythrozoon wenyoni* Adler and Ellenbogen, 1934 (Fig. 6).

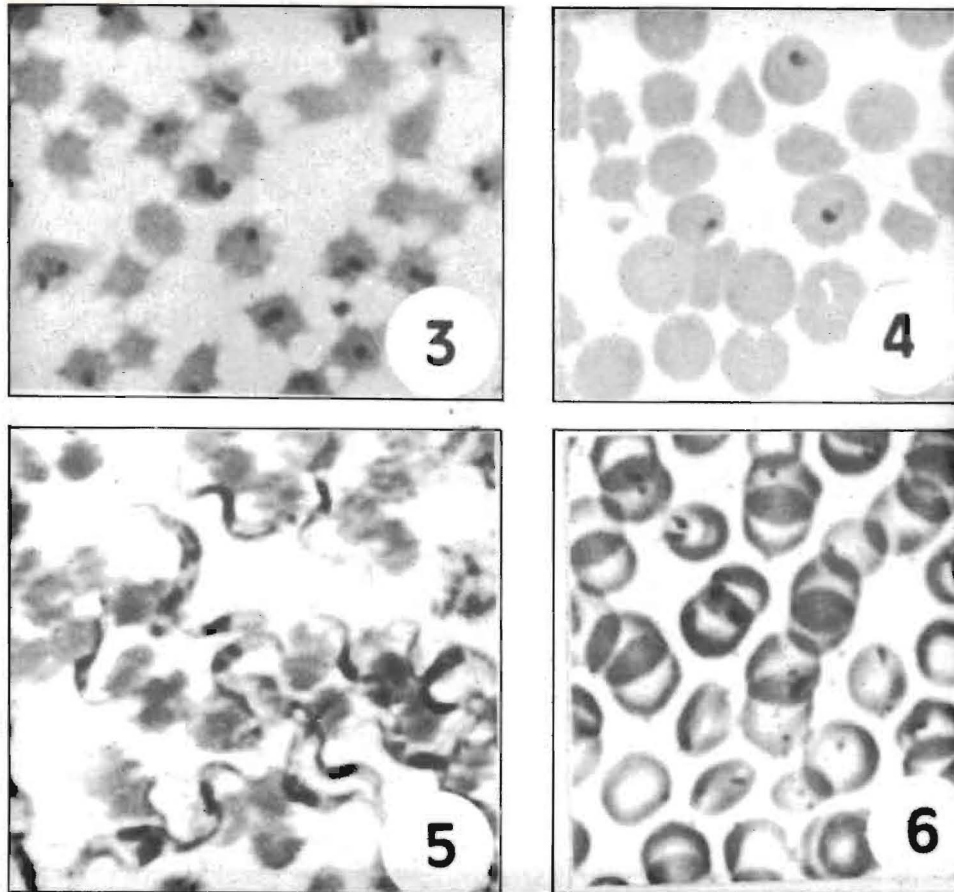
Twenty two of the 135 (16.3%) Najdi camels studied at Riyadh Central Abattoir were infected with *T. evansi*. A strain of the parasite was isolated from these camels in Balb/c mice and with successive syring passage, it became highly virulent to mice (Fig. 5).

Discussion

The present study is the first detailed investigation of the blood parasites infecting indigenous farm animals in Saudi Arabia. Several of these parasites are recorded for the first time in the Kingdom, including *T. ovis*, *T. hirci* and *E. ovis* from sheep and goats, an *Eperythrozoon* sp. from camels as well as *E. wenyoni* and a nonpathogenic *Theileria* sp. from cattle. The report of an *Eperythrozoon* sp. from camels is the first from this host (see Gothe and Kreier 1977, Soulsby 1982, and Saint-Martin 1990). With the exception of *Eperythrozoon suis*, which causes anaemia and jaundice in pigs (Splitter 1950), eperythrozoa are generally nonpathogenic (Gothé and Kreier 1977, and Soulsby 1982). Nevertheless, *E. ovis* has been incriminated in several parts of the world as the cause of anaemia and chronic unthriftiness in sheep (Littlejohns and Foggie 1961, and Øveras 1962).

However, Ilemobade and Blotkamp (1978) have suggested that the parasite can assume clinical significance only under conditions of endemic instability. Sheep and goats found infected with the parasite in the present study were quite healthy. The vector of the parasite in the Kingdom is unknown, but lice (Soulsby 1982) and horseflies (Øveras 1959) are the reported vectors of these parasites.

There is some discrepancy, however, regarding the first report of *T. evansi* from Saudi Arabia. Kasim (1984) claims that his is the first report, while informations compiled by Rutter (1967) and Boid *et al.* (1985) from the OIE/FAO/WHO Animal Health Yearbook of 1965 and 1982, respectively shows



Figs. 3-6. 3, intraerythrocytic forms of *Theileria annulata* from a cow in Hofuf; 4, intraerythrocytic forms of a nonpathogenic *Theileria* sp. from cattle in Gizan; 5, *Trypanosoma evansi* isolated from a Najdi camel in Balb/c mice; 6, *Erythrozoon wenyoni* from a cow in Gizan (x 1600).

that the parasite had been reported from these camels. However, Kasim (1984) might be the first to have actually detect this parasite from Saudi Arabian camels, as others have merely compiled informations without concrete scientific evidence. Nevertheless, the present study is the most extensive, to date, on camel trypanosomiasis in Saudi Arabia. A strain of *T. evansi* was isolated from Najdi camels and is currently maintained by syringe passage in mice. Stabilates of this strain are stored in liquid nitrogen (-196°C) in the laboratory. However, camel trypanosomiasis is known to occur in all countries bordering Saudi Arabia (Boid *et al.* 1985). In the present study, the highest incidence of the disease occurred at Gizan, Hofuf, Al-Kharj, Samitah, Al-Hafr, Buraydah and Najran. These localities are among the best developed agricultural regions in the Kingdom, being provided with considerable water resources. Hence, the prevailing conditions there are favourable for the multiplication of tabanid flies the known mechanical vectors of *T. evansi* (Rutter 1967, Mahmoud and Gtay 1980, Soulsby 1982, and Boid *et al.* 1985). Two species of these flies were identified in the present study, the palaeartic *A. farinosus* from central, eastern and northern parts of the Kingdom and the afrotropical species, *A. agrestis* from south and southwestern parts. Both species are known to occur in the Kingdom (Leclercq 1982, 1986, Amoudi and Leclercq 1988, and Amoudi 1989), but the present study represents their first report from these localities. Our observations indicate that both species might be the mechanical vectors of *T. evansi* in Saudi Arabia. However, Kasim (1984) has suggested that the vector of *T. evansi* in the Kingdom is the hard tick *Hyalomma anatolicum anatolicum* Koch 1844 and this is a biological vector within which the cyclical development of the parasite takes place. He based this assumption on finding flagellates in the haemolymph of the tick he collected from a camel naturally infected with the parasite. However, these flagellates, belonging to a trypanosome species or not are unlikely a Salivarian trypanosome such as *T. evansi*. The figure he supplied as a proof that these flagellates belong to the parasite (his Fig. 2), showed trypomastigotes with the characteristically sharp pointed posterior end and the large, subterminally located (closer to the nucleus than to posterior tip) kinetoplast of the Stercoraria. Thus he had probably detected a Stercorarian trypanosome such as *Trypanosoma theileri* Laveran 1906. Such trypanosomes have previously been reported from hard ticks by Burgdorfer *et al.* (1973) and Shastri and Deshpande (1981) who have suggested *H. a. anatolicum* as a possible vector of that parasite. Moreover, the presence of spheromastigotes argues against the validity of his suggestion that these belong to *T. evansi*. Spheromastigotes have never been detected in any member of the subgenus (*Trypanozoon*) to which *T. evansi* belongs, neither in arthropod or in mammalian hosts nor in culture media (Mendez and Honigberg *et al.* 1972, Cross and Manning 1973, Honigberg *et al.* 1976, and Himuri *et al.* 1977a,b). Spheromastigotes are not known among the developmental stages of the Salivaria (Olsen 1974, and Soulsby 1982). However, there are some former suggestions that

T. evansi might be transmitted by soft and not by hard ticks (Cross and Patel 1922), but these reports have been refuted by Leese (1927). Kasim (1984) has also attributed the low incidence of camel trypanosomiasis (2%) he detected in Saudi Arabian camels to its inefficient vector, *H. a. anatolicum*. In the present study, however, an infection rate of 13.2% has been detected on a nationwide basis, 16.3% in Najdi camels sampled at Riyadh Abattoir and as high as 37.5% and 40% in camels sampled at Hofuf and Gizan, respectively. Moreover, the areas of highest *T. evansi* incidence examined in the present study were found heavily infested with tabanid flies, the most successful mechanical vectors of this parasite (Rutter 1967, Olsen 1974, Woo 1977, Mahmoud and Gray 1980, Soulsby 1982, and Kettle 1984). However, the logical explanation for the low incidence reported by Kasim (1984) might be that he used the less sensitive technique of direct thin smear examination, while the superior MHCT has been employed in the present study.

In sheep and goats, *T. ovis*, as had been reported elsewhere (Uilenberg 1981, and Soulsby 1982), is widespread in Saudi Arabia. While *T. hirci* seems to be confined to the eastern and northern parts of the country, and might be related to its distribution in Iraq (Latif *et al.* 1977). Several tick genera and species had been reported as vectors of *T. ovis* which were corrected by Uilenberg (1981). However, similar to the observations of Bhattacharyulu *et al.* (1972), the vector of this parasite in Saudi Arabia might be *H. a. anatolicum* that has been frequently encountered on sheep and goats in the Kingdom (Al-Khalifa *et al.* 1987, Diab *et al.* 1987, and Hussein *et al.* 1988). Moreover, with respect to the findings of Hooshmand-Rad and Hawa (1973), this tick might also be the vector of *T. hirci* in the Kingdom. *Theileria ovis* is a nonpathogenic parasite, but *T. hirci* is highly pathogenic to sheep and goats with a mortality rate of upto 100% in endemic areas (Uilenberg 1981, and Soulsby 1982). The acute form of the disease is more frequent, but subacute and chronic forms have also been reported and symptoms of the acute disease were seen in infected sheep and goats in the present study. On the other hand, veiled or other nonpathogenic *Theileria* species of small ruminants reported by Uilenberg (1981) were not detected in any of the sheep and goats examined.

Tropical theileriosis of cattle, caused by *T. annulata* was first reported in Saudi Arabia from Al-Hassa Oasis (Hofuf), where several outbreaks with high mortality rates were observed (Cheema *et al.* 1986). In the present study, cattle in the same locality were found similarly infected and several of them showed severe symptoms of the disease. Moreover, a benign *Theileria* sp. was reported for the first time from cattle in Gizan in the southwestern part of the country. A strain of this, as well as of *T. annulata* were isolated and stored in liquid nitrogen for further studies.

Acknowledgement

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دراسات على طفيليات الدم التي تصيب الحيوانات المستأنسة المحلية في المملكة العربية السعودية

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الدراسات الحالية هي أول دراسات من نوعها تُجرى بصورة مستفيضة لطفيليات الدم التي تصيب الحيوانات المستأنسة المحلية في المملكة العربية السعودية، ولقد أُجريت هذه الدراسات بالتزامن مع ما أُجريناه من دراسات سابقة قمنا بها لتحديد أنواع القراد الجامد المستوطن في المملكة العربية السعودية (انظر الخليفة وآخرون عام ١٩٨٧، دياب وآخرون عام ١٩٨٧، وحسين وآخرون عام ١٩٨٨). وكتكملة لتلك الدراسات قمنا بالدراسات الحالية للتعرف على طفيليات الدم التي تصيب الحيوانات المحلية وذلك لأن القراد الجامد هو من أهم النواقل لطفيليات دم الحيوانات المستأنسة والتي تسبب في تلك الحيوانات خسائر اقتصادية كبرى. وعليه فلقد قمنا بجمع عينات دم من الحيوانات المحلية من مناطق البادية التي تحيط بالمدن الموضحة في الشكل رقم ١ على مدى دائرة نصف قطرها حوالي ١٠٠ كم. هذا ولقد تم اختيار مناطق الدراسة بعناية فائقة بعيداً عن أي إختلاط بين الحيوانات المستوردة والمحلية كما هو دأبنا في مثل هذه الدراسات.

لقد تم جمع عينات دم من ١٠ أو أكثر من كل من الإبل والأغنام والماعز من مناطق الدراسة المذكورة. وهذه العينات كانت عبارة عن سحب دم لينة يتم فحصها فوراً مستعملين في ذلك مجهرًا حقيقياً وذلك للكشف على سوطيات الدم.

هذا ولقد استعملنا أيضاً الطريقة الأكثر دقة والتي إبتكرها العالمان كلي وشيلنجر عام ١٩٨٣ للكشف على سوطيات الدم بواسطة الطرد المركزي الدقيق، ولقد قمنا بتعبئة أنابيب شعرية دقيقة من الدم المأخوذ من أوردة الاذن. هذا ولقد قمنا كذلك بعمل سحبات دم رقيقة من أوردة الاذن من هذه الحيوانات، وقمنا كذلك بعمل سحبات من العقد اللمفية الاطرية مثل العقدة الامام كتفية وذلك بغرز ابرة موصلة بحقنة في العقدة ومن ثم تسحب عينة من العقدة تستعمل لعمل سحبات على شرائح زجاجية. تثبت هذه السحبات وسحبات الدم الرقيقة بعد تجفيفها بواسطة كحول مثيلي تركيز ١٠٠٪، ثم تحفظ الشرائح في صناديق بلاستيكية أو خشبية وترحل للمختبر حيث تصبغ بصبغة جيمزا وتفحص بالعدسة الزيتية بحثاً عن أطوار طفيليات الدم. ولقد تم كذلك جمع عينات من دم الإبل النجدية المذبوحة للإستهلاك المحلي بمسلخ الرياض المركزي. جمعت تلك العينات من ١٣٥ من الإبل النجدية من وريد العنق الكبير في أنابيب ساحبة مغطاة بمادة تمنع تخثر الدم (EDTA-Coated Vacutainers). ولقد درست هذه العينات في المختبر بطريقة الطرد المركزي الدقيق التي إبتكرها العالم باتريك وُو في عام ١٩٦٩ ومن ثم طورها في عامي ١٩٧٠ و ١٩٧٤ وذلك لفحص الدم المحتوي على أعداد ضئيلة جداً من سوطيات الدم التابعة لجنس *Trypanosoma*. كما وتم حقن الدم من بعض العينات المصابة داخل التجويف البريتوني لفئران التجارب سلالة Balb/c وذلك بهدف عزل الطفيلي في الفئران المخبرية. هذا ولقد تم عزل سلالة من هذا الطفيلي في الفئران المخبرية، وبعد مدة من تمريرها في الفئران بواسطة الحقن أصبحت تلك السلالة شديدة الإمراضية للفئران، والطفيلي الآن تحت الدراسة لتحديد الخواص الكيميائية الحيوية لتلك السلالة.

لقد تم جمع عينات دم خلال الدراسات من ٣١٠ من الإبل ومن ٣٣١ من الأغنام ومن ٣٤٨ من الماعز، ولقد أوضحت الدراسات أن نسبة الإصابة بسوطيات الدم نوع *Trypanosoma evansi* في الإبل على مستوى المملكة كان ١٣,٢٪ ولقد كانت في الإبل النجدية المفحوصة في مسلخ الرياض المركزي

١٦,٣ ٪. ولقد أوضحت الدراسات أيضاً أن هناك مناطق ذات درجات عالية بالإصابة بهذا الطفيلي حيث بلغت في منطقة جيزان ٤٠ ٪ وفي الهفوف ٣٧,٥ ٪ وفي الخرج ٢٢,٢ ٪ وفي كل من صامته ونجران ٢٠ ٪ كما وفي كل من الحفر وبريدة ١٦,٧ ٪. ولقد شوهدت أعداد كبيرة من ذباب التبانة المزعجة جداً للحيوانات نسبة للساعات المؤلمة جداً، تتغذى على الإبل في تلك المناطق ذات الإصابة العالية. وهذا الذباب يحدث قروحاً في الحيوان تظل تنزف لمدة بعد مغادرته للحيوان، ومن شدة الألم الذي تحدثه لسعة هذا الذباب فإنه نادراً ما يكمل غذاءه على حيوان واحد، حيث أن هياج الحيوان من شدة الألم يطرد الذباب منه وعليه فإنه يترك ذلك الحيوان إلى حيوان آخر ومن ثم لثالث حتى يكمل غذاءه. ولقد شوهدت ذبابة مرت على ٧ من الإبل حتى أكملت تغذيتها. وبهذا التنقل من حيوان لآخر للتغذية، إذا كان احد الحيوانات مصاباً فإن الذباب ينقل الإصابة إلى الآخرين وهكذا فإن ذباب التبانة هو أنجح ناقل ميكانيكي لطفيليات *T. evansi*. ولقد تم جمع عينات من هذا الذباب، حيث وجد نوع *Atylotus farinosus* في مناطق الهفوف والخرج وبريدة ونوع *Atylotus agrestis* والحفر في مناطق جيزان وصامته ونجران. وهذان النوعان يسجلان للمرة الأولى في تلك المناطق في المملكة، وهناك احتمال كبير بأنهما الناقلان الميكانيكيان لهذا الطفيلي في تلك المناطق من المملكة. طفيلي *T. evansi* هو أخطر طفيليات الإبل على الإطلاق ويسبب لها مرض الهيام أو السعار. وهذا المرض قد يحدث بشكل حاد مميت للحيوانات المصابة، ولكن غالباً ما يكون المرض بصورة مزمنة تصحب بفقر الدم والهزال والحمى المتقطعة وتساقط الشعر وأحياناً ما يصاحب المرض المزمن إسهال شديد، وقد تُسقط النوق المصابة أجتتها. هذا ولقد وجدت الإبل مصابة أيضاً بنوع من الطفيليات أولية النواة جنس *Eperythrozoon* بنسبة ٣,٩ ٪، وهذه هي المرة الأولى التي يسجل فيها طفيلي من هذا الجنس في الإبل على الإطلاق.

أما الأغنام والماعز فلقد وُجِدت مصابة ببوغيات الدم نوعي *Theileria ovis* و *Theileria hirci* وكذلك بالطفيلي أولي النواة نوع *Eperythrozoon ovis* وهذه هي المرة

الأولى التي تسجل فيها كل هذه الطفيليات من المملكة العربية السعودية. نوع *T. ovis* منتشر في كل أنحاء المملكة التي درست كما وكان أكثر الطفيليات التي سجلت على الإطلاق إذ وُجد في ١٣٣ من مجموع ٦٧٩ من كل من الأغنام والماعز، بنسبة ١٩,٩٪. أما *T. hirci* فقد وجد في ٤٧ فقط من مجموع الاغنام والماعز، بنسبة ٦,٩٪، وهذا الطفيلي يبدو أنه منتشر في المناطق الشرقية والشالية من المملكة فقط. وهذا قد يكون إمتداداً لمناطق تواجده المعروفة في العراق. أما الطفيلي أولي النواة *E. ovis* فهو أقل طفيليات الأغنام والماعز تواجداً في المملكة بنسبة ٣٪ فقط. نوعي *T. ovis* و *E. ovis* غير ممرضين، أما نوع *T. hirci* فهو شديد الأمراض للأغنام والماعز وقد تصل نسبة النفوق في الحيوانات المصابة به إلى ١٠٠٪ في المناطق الموبوءة. وغالباً ما يكون المرض بشكل حاد وهو مصحوب بحمى شديدة ويرقان ونزيف بحجم رأس الدبوس في الأغشية المخاطية والأغشية تحت الجلدية، كما وهنالك تضخم في الطحال والعقد اللمفية، وقد يوجد في بعض الاحيان دم في البول في بداية الإصابة. المعروف عن طفيليات جنس *Eperythrozoon* أنها تنقل إما بواسطة القمل أو بواسطة ذباب التبان، أما الناقل لهذه الطفيليات في المملكة فلم يحدد بعد. أما بوغيات الدم نوعي *T. hirci* و *T. ovis* فهنالك احتمال كبير بان الناقل لكل منهما في المملكة قد يكون القراد الجامد نوع *Hyalomma a. anatolicum*.

الأبقار التي فُحصت في منطقتي الهفوف وجيزان وُجدت مصابة بالطفيلي أولي النواة نوع *Eperythrozoon wenyoni* وهذا الطفيلي يسجل للمرة الأولى كذلك في المملكة. الأبقار في منطقة الهفوف وُجدت كذلك مصابة ببوغيات الدم نوع *Theileria annulata* وهذا الطفيلي يسبب مرض الحمى المدارية *Tropical theileriosis*، ولقد سُجِّل هذا الطفيلي من قبل في نفس المنطقة عام ١٩٨٦ وهو ذو أمراضية عالية للأبقار. اما الأبقار في منطقة جيزان فلقد وجد بها طفيلي آخر من جنس *Theileria* متدني الأمراض، وهذا الطفيلي يسجل للمرة الأولى في المملكة وهو ليس شبيهاً ببوغيات دم الأبقار متدنية الأمراض من مجموعة *sergenti / orientalis* لا من ناحية الشكل ولا من النواحي البيولوجية. هذا ولقد تم عزل سلالة من

هذا الطفيلي في العجول التي أُزيل منها الطحال وهو الآن تحت الدراسة لتحديد نوعه. ولقد تم أيضاً عزل سلالة من *T. annulata* وهذا الطفيلي أيضاً تحت الدراسة في مختبراتنا. كل سلالات الطفيليات *T. annulata* و *T. evansi* ونوع بوغيات الدم الذي تم عزله من الأبقار في جيزان محفوظة الآن في المختبر في النيتروجين السائل في درجة حرارة ١٩٦° مئوية تحت الصفر للدراسات المستقبلية. وهذه هي المرة الأولى التي تعزل فيها سلالات من هذه الطفيليات في المملكة العربية السعودية وتُخزن في النيتروجين السائل.