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Ticks (Acari: Ixodidae) Infesting Local Domestic Animals in Western and Southern Saudi Arabia[1]

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ABSTRACT. A survey of local livestock in western and southern Saudi Arabia yielded seven indigenous and six introduced tick species and subspecies. The introduced *Boophilus annulatus, Hyalomma marginatum rufipes, Amblyomma gemma, Amblyomma variegatum, Hyalomma truncatum* and *Rhipicephalus evertsi evertsi* are well established especially in Jāzān and Najran Provinces and their threat to human and domestic animals' health is highlighted. *Hyalomma dromedarii* is the most abundant and widespread species in the area. Jāzān and Najran Provinces proved to be its main regions of distribution in the Kingdom. This species coexists on the camel with *Hyalomma impeltatum* throughout the study area. The Sarawat Mountain range, especially in Makkah Province, is the home of two relict parasites *Hyalomma arabica* and *Boophilus kohlsi;* both chiefly infest the goat, but their postulated host is the Nubian Ibex, *Capra ibex nubiana* (Cuvier). *Rhipicephalus turanicus* occurs in Al-Madina, Makkah and Asir Provinces which represent a western and southern extension of its northern and eastern range in the Arabian Peninsula. Jāzān Province is the main area of distribution of *Hyalomma anatolicum anatolicum* in the Kingdom, with cattle and sheep as the main hosts for adult ticks. *Hyalomma anatolicum excavatum* is mainly distributed on sheep and camels in eastern, central and northern Saudi Arabia.

Hoogstraal and Kaiser (1959a) were the first to report on ticks of Saudi Arabia. Since then several reports were made on these arthropods from Saudi Arabia (Banaja and Roshdy 1978, Banaja *et al.* 1980, Abou-Elela *et al.* 1981, Hoogstraal *et al.* 1981). However, these records are handicapped by the lumping of data from both local and imported livestock. Such handicap was later remedied in a countrywide survey based on samples of tick populations maintained and are breeding in the Kingdom that were collected only from local livestock in localities

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away from possible mixing with imported animals (Al-Khalifa *et al.* 1983, 1984; 1986; Hoogstraal *et al.* 1984, Al-Asgah *et al.* 1985, Al-Khalifa and Diab, *et al.* 1986, Diab *et al.* in press).

The present paper is a part of a 5-year nationwide tick programme and is reporting on ticks collected from indigenous livestock in western and southern Saudi Arabia.

Material and Methods

Random deticking of at least 10 animals from herds of local camels, sheep, goats and cattle together with some horses was undertaken in western and southern regions of Saudi Arabia. This was carried out at the localities shown in Fig. 1 over a 2-year period (1980-1982), where tick collections were made at a radius of at least 100 km around each locality. The localities were carefully selected away from possible mixing between local and imported livestock.

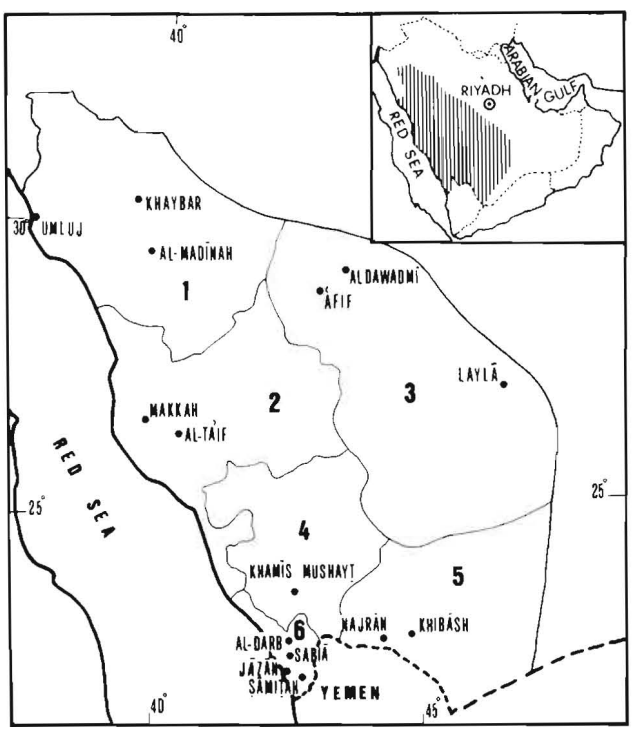

Fig. 1. Western and southern Saudi Arabia showing urban centes in areas surveyed for ticks in different provinces, 1. Al-Madinah; 2. Makkah; 3. Riyadh; 4. Asir; 5. Najran and 6. Jāzān.

Ticks from each animal were collected into 25 × 100 mm-vials containing 70% alcohol. Vials containing ticks were taken to the laboratory where ticks were identified according to the keys of Hoogstraal (1956), Hoogstraal and Kaiser (1959b) and Hoogstraal *et al.* (1981). Our identifications were confirmed and commented upon by the late Dr. Harry Hoogstraal of the Medical Zoology Department, United States Naval Medical Research Unit No. 3, Cairo, Egypt.

Maximum and minimum temperature, relative humidity and rainfall of the study area during the 2-year study period were obtained from the Hydrology Division, Ministry of Agriculture and Water, Riyadh.

Results

Physogeography, Climate and Vegetation

The main physiogeographical feature of the study area is the Sarawat Mountain Range which extends from the south-western tip of the Arabian Peninsula in a northernly direction along the Red Sea Coast in Yemen and Saudi Arabia. The highest altitude of the range in Saudi Arabia is at Taif (about 1500 m above sea level) and Asir Province (about 2190 m above sea level). There are several *Tihamahs* (or foothills) and Wadis (valleys) on either side of the range. The bulk of Asir Province and Taif of Makkah Province are cultivated areas with several terraces on the mountainside. The rest of the study area is a pastoral region where large herds of camels, sheep and goats, kept by Bedouins, roam the area. Cattle and horses, on the other hand, are sedentary animals kept by farmers in certain localities. Jāzān and the western side of Riyadh Province (Al-Dawadmi and Afif) are sandy deserts while Najran and Al-Medina areas (Fig. 1) are scrublands.

The climate at Taif and Asir is very mild and these areas constitute the main summer resorts of the Kingdom. Elsewhere, in the area of study, the climate is mild in winter, hot and dry in summer, except at Jāzān Province which is hot and humid (Table 1). Rainfall varied from 73.6 mm at Najran to 432.6 mm at Asir (Table 1) and most of the precipitation was in spring, except at Asir where it occurred in winter.

Vegetational cover is plentiful at Asir and, to some extent, at Taif where the escarpment is mostly wooded with a relatively rich growth of *Acacia* trees and scattered large *Ficus pseudosycamorus* trees, as well as, bushes and perennial shrubs including *Delonix* spp., *Tamarindus* spp., *Anagyris* spp., and *Ziziphus* spp. Elsewhere in the study area, vegetational cover is sparse and consists mainly of annuals. Some of the commonst vegetation in the area of study include *Euphorbia* spp., *Calotropis procera, Citrullus colocynthis, Convolvulvus* spp., *Arnebia hispidissima, Blepheris cillaris, Launaea* spp., *Onopordium ambiguum, Pegolettia*

senegalensis Euryops arabicus, Atriplex leucoclade, Hammada elegans, Rhayza stricta, Olea chrysophylla, and *Salvadora persica.* A full list of vegetation of the area of study is given by Migahid (1978).

Table 1. Climatic parameters in western and southern Saudi Arabia during the period of study (1980-1982)

Province	Season	Mean air temperature (°C)		Mean relative humidity (%)	Total rainfall* (mm)
		Minimum	Maximum		
Al-Madina	Winter	10.3	27.3	37 - 45	222.4
	Summer	20.7	43.1	15 - 41	
Makkah	Winter	5.8	23.6	46 - 60	204.2
	Summer	14.1	35.3	14 - 43	
Riyadh	Winter	6.5	22.5	50 - 60	236.6
	Summer	19.7	41.8	18 - 37	
Asir	Winter	8.3	17.0	74 - 84	432.6
	Summer	11.4	29.2	52 - 64	
Najran	Winter	6.2	31.1	47 - 51	73.6
	Summer	10.6	38.4	24 - 38	
Jāzān	Winter	22.2	34.4	63 - 74	128.7
	Summer	27.2	40.6	56 - 69	

* Most precipitation occurred in spring except at Asir where it occurred in winter.

Tick Species Infesting Local Domestic Animals

A total of 2190 ticks were collected from local camels (1392 ticks), goats (418), sheep (215), cattle (143) and horses (22). These comprise 2,110 adult ticks and 80 nymphs collected mostly from animals at Jāzān Province (845 ticks), while sheep only have yielded 17 adult ticks at Khamis-Musheet, Asir Province and considerable numbers of ticks were collected from the other areas sampled (Table 2).

Seventy of the nymphs were collected from camels in various parts of the study area and all belonged to the genus *Hyalomma,* while six of the 10 nymphs collected from cattle at Jāzān Province (Table 2) were *Boophilus* sp. nymphs, two *Hyalomma* spp. and two *Amblyomma* spp. nymphs.

The 2,110 adult ticks collected comprise 13 species and subspecies in four genera of the family Ixodidae. Seven of these belong to the genus *Hyalomma* which comprises 83.8% of the sample and two species each in the genera *Rhipicephalus, Boophilus,* and *Amblyomma.* Camels were the most heavily tick-infested animals and horses were the least (Table 3).

Table 2. Numbers of ixodid ticks collected from various domestic animals in western and southern Saudi Arabia

Province	Adult ticks					Nymphs*					Total
	Camels	Sheep	Goats	Cattle	Horses	Camels	Sheep	Goats	Cattle	Horses	
Al-Madina*	210	24	20	1	1	0	0	0	0	0	256
Makkah	75	124	393	1	ND	3	0	0	0	0	596
Riyadh**	203	0	0	ND	ND	2	0	0	ND	ND	205
Asir	ND	17	0	0	ND	ND	0	0	0	ND	17
Najran	242	0	0	3	21	5	0	0	0	0	271
Jāzān	592	50	5	126	ND	60	0	0	10	ND	843

*: All nymphs from camels are *Hyalomma* spp., those from cattle are: 2 *Hyalomma* spp., 6 *Boophilus* spp. and 2 *Amblyomma* spp.
**: Only western part of the province (Al-Dawadmi and Afif).
ND: Not determined due to inavailability of animals.

Table 3. Tick species and subspecies infesting local domestic livestock in western and southern Saudi Arabia

Tick species of subspecies	Camels	Sheep	Goats	Cattle	Horses	Total	Percent of sample
Hyalomma dromedarii	998	4	0	34	11	1047	49.6
Hyalomma arabica	0	44	203	0	0	247	11.7
Hyalomma impeltatum	224	3	2	1	3	233	11.0
Hyalomma anatolicum anatolicum	20	50	8	70	0	148	7.0
Hyalomma anatolicum excavatum	50	0	0	03	7	60	2.8
Hyalomma marginatum rufipes	27	1	0	0	1	29	1.4
Hyalomma truncatum	3	0	0	1	0	4	0.2
Hyalomma ssp. combined	1322	102	213	109	22	1768	83.8
Rhipicephalus turanicus	0	112	201	2	0	315	14.9
Rhipicephalus evertsi evertsi	0	1	0	3	0	4	0.2
Boophilus annulatus	0	0	0	15	0	15	0.7
Boophilus kohlsi	0	0	4	0	0	4	0.2
Amblyomma variegatum	0	0	0	2	0	2	0.1
Amblyomma gemma	0	0	0	2	0	2	0.1
Total	1322	215	418	133	22	2110	

Hyalomma dromedarii Koch was the most abundant (49.6% of the sample) and widespread tick species in the study area. This species was collected from every locality sampled (Fig. 1), especially from camels which yielded 95.3% of the specimens collected (Tables 3 and 4). Camels at Jāzān Province, especially those at Samtah, (Fig. 1) yielded most specimens, while only 2 ♂ and 2 ♀ were collected from camels at Taif (Table 4). This tick species was also collected from sheep at Makkah (Table 5), from cattle and horses at Najran and from cattle at Jāzān (Table 6). Goats examined at all localities were not infested with this species.

Rhipicephalus turanicus Pomerantzev and Matikashvili, the second most abundant tick species in the sample, represented 14.9% of adult ticks collected (Table 3). Apart from 1 ♂ collected from a cow at Makkah and 1 ♂ collected from a cow at Jāzān, this tick infests only goats and sheep (Table 3). Goats followed by sheep at Makkah Province yielded most specimens in the sample. The same animals at Al-Medina Province yielded fewer specimens and only 16 ticks were collected from sheep at Asir and three from goats at Jāzān (Table 5).

Hyalomma arabica Pegram, Hoogstraal and Wassef represents 11.7% of the sample; 203 ticks were collected from goats and 44 from sheep (Table 3) and all were only from Makkah Province (Table 5).

Table 4. Tick species infesting local camels in western and southern Saudi Arabia

Province	Locality	*H. dromedarii*		*H. impeltatum*		*H.a. anatolicum*		*H.a. excavatum*		*H.m. rufipes*		*H. truncatum*	
		♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Al-Medina:	Al-Medina	42	25	10	3	1	0	5	0	0	0	0	0
	Khiber	41	22	13	7	0	0	9	4	0	0	0	0
	Umluj	12	2	4	2	0	0	8	0	0	0	0	0
Makkah:	Makkah	34	22	7	5	0	0	0	1	0	0	0	0
	Taif	2	2	2	0	0	0	0	0	0	0	0	0
Riyadh:	Al-Dawadmi	45	11	6	3	0	1	0	1	0	0	0	0
	Afif	48	45	22	15	0	0	2	4	0	0	0	0
Najran:	Najran	50	28	10	3	0	0	3	2	3	2	0	1
	Khibash	48	42	18	23	0	0	6	3	0	0	0	0
Jāzān:	Jāzān	82	48	18	9	1	1	1	0	0	0	0	0
	Al-Darb	35	35	8	0	0	0	0	0	0	0	0	0
	Sabia	50	43	6	5	0	0	0	0	17	5	1	1
	Samtah	111	73	22	3	16	0	0	1	0	0	0	0
Total		600	398	146	78	18	2	34	16	20	7	1	2

Table 5. Tick species and subspecies infesting local sheep and goats in western and southern Saudi Arabia

Province	*Rhipicephalus turanicus*				*Hyalomma a. anatolicum*				*Hyalomma impeltatum*				*Hyalomma dromedarii*				*Hyalomma arabica*			
	Sheep		Goats		Sheep		Goats		Sheep		Goats		Sheep		Goats		Sheep		Goats	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Al-Medina	15	8	12	8	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Makkah*	52	21	81	97	2	0	3	3	0	0	2	0	1	3	0	0	25	19	97	106
Riyadh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Asir**	9	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Najran	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jāzān	0	0	1	2	25	23	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Total	76	36	94	107	27	23	4	4	2	1	2	0	1	2	0	0	25	19	97	106

* 1 ♂ and 3 ♀ *Boophillus kohlsi* were collected from goats, 1 ♂ *Hyalomma m. rufipes* was collected from sheep.

** 1 ♂ *Rhipicephalus evertsi* was collected from an ewe.

Table 6. Tick species and subspecies infesting local cattle and horses in western and southern Saudi Arabia*

Province	*Hyalomma a. anatolicum*				*Hyalomma a. excavatum*				*Hyalomma dromedarii*				*Hyalomma impeltaatum*				*Boophilus annulatus*			
	Cattle		Horses		Cattle		Horses		Cattle		Horses		Cattle		Horses		Cattle		Horses	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Al-Medina	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Najran**	0	0	0	0	0	0	5	1	1	2	10	1	0	0	1	2	0	0	0	0
Jāzān***	46	23	ND	ND	2	1	ND	ND	18	13	ND	ND	1	0	ND	ND	9	6	ND	ND
Total	47	23	0	0	2	1	5	2	19	15	10	1	1	0	1	2	9	6	0	0

* Cattle and horses were not available for examination at Al-Dawadmi or at Afif, Riyadh Province. Cattle examined at Khamis-Musheet, Asir Province yielded no ticks, 1 ♂ *Rhipicephalus turanicus* was collected from a cow at Makkah.

** 1 ♂ *Hyalomma m rufipes* was collected from a horse at Najran.

*** 2 ♂ *Amblyomma variegatum* and 2 ♂ *Amblyomma gemma* were collected from cattle. 1 ♂ *Hyalomma truncatum* and 1 ♂ *Rhipicephalus turanicus* were collected from a cow. 1 ♂ and 2 ♀ *Rhipicephalus evertsi* were collected from cattle. 10 nymphs were collected from cattle comprizing 6 *Boophilus* spp. 2 *Hyalomma* spp. and 2 *Amblyomma* spp.

ND: Not determined due to inavailability of animals.

Hyalomma impeltatum Schulze and Schlottke represents 11% of the sample and was collected from all animals species sampled, but the camel was its main host; 224 of the 233 specimens collected were from this animal (Table 3). Camels at Khibash were the most heavily infested with this species followed by those at Afif, Jāzān and Samtah (Fig. 1), whilest only 2 ♂ were collected from camels at Taif (Table 4).

Hyalomma anatolicum anatolicum Koch represents 7% of the sample and was collected from all animal species sampled except horses (Table 3). However, most ticks were collected from cattle, sheep and camels at Jāzān Province (Tables 2, 5 and 6) and 6 of the 8 ticks collected from goats were from Makkah Province and the other two were from Jāzān Province (Table 5).

The other subspecies, *Hyalomma anatolicum excavatum* Koch represents only 2.8% of the sample and occurred mainly on camels (50 of the 60 specimens) throughout the area of study (Table 4) together with 7 specimens from horses (5 ♂ and 2 ♀ at Najran and Al-Medina) and 3 (2 ♂ and 1 ♀) from cattle at Jāzān (Table 6).

The remaining seven tick species and subspecies represent only 2.9% of the sample (Table 3) and all except *Boophilus kohlsi* Hoogstraal and Kaiser (0.2% of the sample) are species non-indigenous and introduced into the Kingdom. Of these, *Hyalomma marginatum rufipes* Koch represents 1.4% of the sample (Table 3); 27 of the 29 specimens collected came from camels and 27 of these were from camels at Sabia in Jāzān Province (Fig. 1) and the remaining five were from camels at Najran Province (Table 4). In addition 1 ♂ was collected from a horse at Najran and another 1 ♂ from a ram at Makkah.

The other five introduced species in the sample are *Boophilus annualtus* (Say) (0.7% of the sample). 9 ♂ and 6 ♀ all from cattle at Abu Arish, a suburb of the city of Jāzān (Table 6), *Rhipicephalus evertsi evertsi* Neumann (0.2% of the sample), 1 ♂ and 2 ♀ from cattle at Jāzān, and 1 ♂ from an ewe at Khamis-Musheet, Asir Province, *Hyalomma truncatum* Koch (0.2% of the sample), 1 ♂ and 1 ♀ from a camel at Sabia, 1 ♂ from a camel at Najran and 1 ♂ from a cow at Jāzān, 2 ♂ *Amblyomma variegatum* (Fabricius) and 2 ♂ *Amblyomma gemma* Dönitz from cattle at Jāzān.

Boophilus kohlsi was collected from goats only in Makkah Province; 1 ♀ from Makkah, 1 ♂ and 2 ♀ from Taif.

Discussion

The tick samples collected in the present study are the largest and most varied samples in the current 5-year country-wide tick programme. The bulk of these ticks came from camels, especially at Jāzān Province, a hot semidesert in the south-western corner of Saudi Arabia (Fig. 1). Camels in that region were heavily infested with *H. dromedarii* and their infestation rate is only matched by that of *Hyalomma schulzei* Olenev on camels in the northern frontier region of the Kingdom (Al-Asgah *et al.* 1985 and Diab *et al.* in press). Moreover, Camels in Jāzān Province are also heavily infested with *H. impeltatum* and other *Hyalomma* species (Table 3). The tick infestation rate was also high on camels at Najran Province, followed by those in the western side of Riyadh Province (Al-Dawadmi and Afif, Fig. 1) and those at Al-Medina Province. Camels at Makkah Province were the least tick-infested and no camels were available for examination at Khamis-Musheet, Asir Province. In Makkah Province, camels examined at Taif have yielded only six tick specimens. This is understandable, because the major tick species infesting the camel in the area of study, *H. dromedarii* and *H. impeltatum* are known to be drastically affected by altitude (Hoogstraal 1956, Hoogstraal *et al.* 1981; Pegram *et al.* 1982a). This is further demonstrated in the present study by the higher tick-infestation rate of camels in Jāzān Province, the lowest region in the study area.

The area of study is also the home of *H. arabica* a species related to *Hyalomma kumari* Sharif, *Hyalomma punt* Hoogstraal, Kaiser and Pedersen and *Hyalomma rhipicephaloides* Neumann *H. arabica* is indigenous to the Sarawat Mountains in Yemen as well as in Jāzān, Asir and Makkah Provinces of Saudi Arabia (Hoogstraal *et al.* 1981, 1983; Pegram *et al.* 1982 a,b; Diab *et al.* 1985; Al-Khalifa *et al.* 1986). The immature stages of the tick were found parasitizing the spiny mouse, *Acomys d. dimidiatus* (Cretzchmar) in Makkah Province (Diab *et al.* 1985) and in the present study the tick was only found in Taif and Makkah, Makkah Province which seems to be the main area of its distribution in the Kingdom. The goat seems to be the current preferred host for adults of this species which also infest sheep, but the Nubian Ibex, *Capra ibex nubiana* (Cuvier) was postulated by Pegram *et al.* (1982b) to be the original host for adults of this relict parasite. Pegram *et al.* (1982a) have collected this species from goats and sheep in Yemen throughout the year, but in the present study, the tick seems to be highly seasonal in Saudi Arabia. Work is currently undertaken to study the seasonal dynamics of this species in Makkah Province.

Another tick species of interest in the area of study is *B. kohlsi,* which probably originally parasitized the Nubian Ibex too and possibly coexists or shares the same or somewhat similar biotopes to those of *H. arabica* (Hoogstraal *et al.* 1981; Pegram *et al.* 1982a). The tick was described from sheep and goats in Jordan

by Hoogstraal and Kaiser (1960a). Since then several samples were collected especially from goats in Jordan, Jordanian-Palestinian frontiers, Mosul District in Iraq, Yemen and Makkah Province of Saudi Arabia (Hadani *et al.* 1964; Hoogstraal *et al.* 1981; Pegram *et al.* 1982a). Moreover, several specimens were collected from goats in the Eastern Province of Saudi Arabia (Diab *et al.* in press), and there is some evidence that the infestation by this tick in Saudi Arabia is highly seasonal. Further work is needed to investigate the seasonal dynamics of this tick in Saudi Arabia.

Rhipicephalus turanicus was found in the present study infesting goats and sheep at Makkah, Al-Medina and Asir Provinces. These locations seem to represent a western and southern extension of the range of this species in the Arabian Peninsula. The northern and eastern regions of Saudi Arabia are the main areas of distribution of the tick in the Arabian Peninsula (Diab *et al.* in press). These regions form a part of the range of this tick species which is from northern Africa and Southern Europe to China (Morel and Vassiliades 1963) and India (Dhanda and Rao 1969) with goats and sheep as its main hosts. *Rhipicephalus turanicus* had been frequently misidentified as *Rhipicephalus sanguineus* (Latéril-le) and *Rhipicephalus secundus* but Morel and Vassiliades (1963) have ascertained the identity of the species and have synonymized *R. secundus* with it.

The other tick species in the sample indigenous to Saudi Arabia are *H. a. anatolicum* and *H. a. excavatum* which are amongst the most widely distributed tick species in the Kingdom. The present results, as well as data from the current tick programme (Al-Khalifa *et al.* 1983, 1984; Al-Khalifa and Diab 1986; Diab *et al.* in press) indicate that *H. a. excavatum* occurs mainly in northern, eastern and central Saudi Arabia, whilest *H. a. anatolicum* is mainly distributed in the south-western parts of the country. The former subspecies is associated with camels and the latter with cattle and sheep. In Egypt (Hoogstraal and Kaiser 1959b), northern Sudan (Karrar *et al.* 1963), and Syria (Liebish and Zukari 1978), *H. a. anatolicum* is more prevalent in irrigated areas, whilest *H. a. excavatum* replaces it in prevalence in deserts and more arid regions. This was later demonstrated by Pegram *et al.* (1982a) in Yemen Arab Republic where *H. a. excavatum* was abundant on camels in arid areas, less abundant in moderate rainfall areas and rare in high rainfall subhighlands. *H. a. excavatum* is also absent from the Dhofar area of the Sultanate of Oman (Hoogstraal 1981).

In the present study, a total of six introduced tick species and subspecies were represented in the sample: *A. gemma, A. variegatum, B. annulatus, H. m. rufipes, H. truncatum,* and *R. e. evertsi.* These, as well as others (Hoogstraal 1981) are introduced into Saudi Arabia possibly on livestock imported for slaughter from Somalia, Sudan, Egypt and India, or entering from Yemen or brought by migrating birds. The present results indicate that these species and subspecies are members of

tick populations breeding and maintained in Saudi Arabia, since the collections were from local livestock in carefully selected areas far away from any possible mixing with imported livestock.

Amblyomma gemma is widely distributed in more arid areas of Ethiopia (Morel 1980, Pegram *et al.* 1981), Kenya and Tanzania (Walker 1974) and Somalia (Pegram 1976). The tick was probably carried as nymphs on northwards migrating birds from its native East Africa as far as the Crimea, Ukrainian SSR (Klyushkina 1972). A male was taken from a cow at Ta'izz, Yemen (Hoogstraal and Kaiser 1959a) but the tick does not seem to have established itself there (Pegram *et al.* 1982a).

Amblyomma variegatum is common in the African Savannah from Zambia and Angola to central Sudan and Senegal (Hoogstraal 1956) as well as in the mountains of Yemen (Hoogstraal and Kaiser 1959a and Pegram *et al.* 1982a) and the Dhofar area of the Sultanate of Oman (Hoogstraal 1981). Immatures feed on a variety of birds that have carried them as far as France, Italy, Bulgaria and Palestine, where they have moulted into adults (Hoogstraal 1981). However, Hoogstraal *et al.* (1981) are of the opinion that this species could have been introduced into southwestern Saudi Arabia as an extension of its range in the mountains of Yemen.

Boophilus annulatus is a native of the southern part of the Palaerctic Faunal Region, from Kazakhstan, Afghanistan and Iran to the western Mediteranean area from where it was transported by Spanish colonialists with horses or cattle to Mexico and spread to southern United States (Hoogstraal 1973). It is also scattered in favourable African biotopes north of the equator (Hoogstraal 1956) and has also been introduced into French Polynesia (Rageau and Vervent 1960). The tick is quite common in the mountains of Yemen (Hoogstraal and Kaiser 1959a and Pegram *et al.* 1982a) as well as in the Dhofar area of the Sultanate of Oman (Hoogstraal 1981). However, Hoogstraal *et al.* (1981) were uncertain whether the Saudi Arabian populations of the tick represents natural outliers of the southwest Asia distribution of the tick or more or less permanent foci established following introduction with cattle. The present results, as well as data from the current 5-year tick programme indicate that *B. annulatus* is well-established in the Jāzān Province of Saudi Arabia.

Hyalomma marginaltum rufipes is widely distributed in Africa south of the Sahara, in the Nile Valley to the Delta and in Libya (Hoogstraal 1956, Hoogstraal and Kaiser 1958a,b; 1960b; and Hoogstraal 1979). The tick is also widely distributed in Yemen, especially at higher and humid areas (Hoogstraal and Kaiser 1959a and Pegram *et al.* 1982a), but appears to be rare in the Sultanate of Oman (Hoogstraal 1981). Immatures feed on birds that carry them each spring from

Africa to the lower Volga Basin of Astrakhan Oblast, as well as into southwestern Asia where they moult into adults that infest domestic animals (Hoogstraal 1979). The present results, as well as data from the current 5-year countrywide tick programme indicate that *H. m. rufipes* is well-established in both of Najran and Jāzān Provinces of Saudi Arabia with camels as its main hosts. These results might confirm the belief of Hoogstraal *et al.* (1981) that established populations of *H. m. rufipes* may have existed in Saudi Arabia.

Similar to the observations of Pegram *et al.* (1982a), the circumspiracular setae and scutal punctations of Saudi Arabian populations of *H. m. rufipes* are less dense than African samples. This might add some support to the suggestions of Hoogstraal *et al.* (1981) that the Arabian Peninsula is an area of intergradation and/or succesful hybridization between the widely distributed subspecies *H. marginatum rufipes* (Ethiopian Faunal Region) and *Hyalomma marginatum turanicum* Pomerantzev (Palaearctic Faunal Region) both introduced by migrating birds. A similar suggestion was made earlier by Hoogstraal and Kaiser (1960b) for *H. m. rufipes* in Libya.

The present results suggest that *H. truncatum* and *R. e. evertsi* are in the process of establishing themselves in Saudi Arabia. This support the belief of Hoogstraal *et al.* (1981) that the former species might be able to survive in the hills of southwestern Saudi Arabia, and that, if the latter species is not already established in the country, vigillance should be exercised to prevent its spread from imported livestock to local herds. Both species might have been introduced on livestock imported from their African homeland, as their immature stages favour rodents and rarely feed on birds (Hoogstraal 1956, Morel 1980). Both species are absent from the Sultanate of Oman (Hoogstraal 1981), but only *R. e. evertsi* exists in the mountains of Yemen (Hoogstraal 1956, Pegram *et al.* 1982a).

Apart from *B. kohlsi* and *H. arabic* whose disease relations are not yet studied, the tick species and subspecies reported in the present study are vectors of important pathogens of man and domestic animals. The medical and veterinary importance of the indigenous tick species in the present sample, as well as those of *H. m. rufipes* are already reviewed (Al-Khalifa *et al.* 1984, Diab *et al.* in press). Of the introduced species, *B. annulatus* is the famous Texas cattle fever (*Babesia bigemina infection*) tick, the first arthropod ever proven to be a vector of a protozoan parasite (Smith and Kilbourne, 1893). Moreover, the Crimean-Congo haemorrhagic fever (CCHF) virus (Bunyaviridae, *Nairovirus*) as well as Jos virus (unclassified) were isolated from *B. annulatus* in several parts of the world (Hoogstraal 1979). *Amblyomma variegatum* and *H. truncatum* are proven vectors of CCHS virus too (Andronikou *et al.* 1981 and Hoogstraal *et al.* 1981); seven other tickborne viruses were isolated from the former species, three from the latter, and two from *R. e. evertsi* (Hoogstraal *et al.* 1981). *Amblyomma*

variegatum is also the vector of *Cowdria ruminantium,* the agent of heartwater fever of ruminants, as well as of *Rickettsia conori,* the agent of human tick typhus (boutonneuse fever), and of *Coxiella burneti,* the rickettsial agent of human Q fever (Hoogstraal *et al.* 1981). *Rickettsia conori* is also transmitted by *R. e. evertsi* (Hoogstraal *et al.* 1981) and *C. burneti* by *H. truncatum* (Philip *et al.* 1966), the bite of which was also reported to cause human and canine tick paralysis (Erasmus 1952, Swanepoel 1959). Moreover, *A. variegatum* is a known vector of various *Theileria* species infecting domestic animals, whilest *R. e. evertsi* is a vector of several *Babesia* species of wild and domestic equines, as well as of cattle (Hoogstraal 1956, Hoogstraal *et al.* 1981). The large *Amblyomma* hypostome inflicts large wounds that ulcerate and become secondarily infected by other agents.

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القراد المتطفل على الحيوانات الأليفة المحلية في غرب وجنوب المملكة العربية السعودية

محمد بن صالح الخليفة و حسين سر الختم حسين
و ناصر عبدالله الأصقه و فتحي مسلم دياب

قسم علم الحيوان ـ كلية العلوم ـ جامعة الملك سعود ـ ص. ب: ٢٤٥٥
الرياض ١١٤٥١ ـ المملكة العربية السعودية

الدراسة الحالية تمثل جزءً من بحث شامل استغرق مدة خمسة أعوام للتعرف على أنواع القراد المستوطنة في جميع أنحاء المملكة العربية السعودية والدخيلة على تلك المناطق، والتي تمكنت من العيش والانتشار في بيئة المملكة، وذلك بحصر الدراسة على الحيوانات المحلية، المولودة والمربّاة محلياً في المملكة وفي مناطق تبعد كثيراً عن أماكن الاختلاط المحتمل بين الحيوانات المستوردة والمحلية.

ولقد أجريت الدراسة الحالية في مناطق المدينة المنورة ومكة المكرمة والجزء الغربي لمنطقة الرياض (منطقتي الدوادمي وعفيف) وعسير وجيزان ونجران، وذلك بجمع القراد من عشرة حيوانات في الأقل من كل من الجمال والأغنام والماعز والأبقار والخيول المحلية في منطقة نصف قطرها في الأقل مائة كيلو متر حول كل من المدن المبينة في الشكل رقم واحد.

يجمع القراد من الحيوانات في أنابيب بحجم ٢٥×١٠٠ مليمتر محتوية على كمية من الكحول (٧٠٪)، وفي المختبر تنظف هذه العينات وتصنف باستعمال مفاتيح التصنيف التي نشرها هوجسترال عام ١٩٥٦م وهوجسترال وقيصر عام (١٩٥٩م) وهوجسترال وآخرون عام (١٩٨١م)، ولقد قام العالم هوجسترال (توفى عام ١٩٨٦م) بالتأكيد والتعليق على تصنيفنا لهذه القراديات. ولقد أوضحت الدراسة وجود ٧ أنواع محلية و٦ أنواع دخيلة على المملكة من القراديات تابعة للأجناس *Amblyomma, Boophilus, Rhipicephalus, Hyalomma*، والأنواع الدخيلة من القراد والتي تمكنت من العيش والتكاثر وبخاصة في مناطق جيزان ونجران من المملكة العربية

السعـــوديـــة هي : *Boophilus annulatus* و *Hyalomma marginatum rufipes* و *Amblyomma gemma* و *Amblyomma variegatum* و *Hyalomma truncatum* و *Rhipicephalus evertsi evertsi* ولقـد وضح في المنـاقشة الأخـطار الجسيمة التي تحملهـا هذه الأنـواع من القراديـات للإنسان والحيوان. كما وأوضحت الـدراسة أن نـوع *Hyalomma dromedarii* هو الأكـثر شيوعاً وإنتشاراً في منطقة الدراسة الحالية حيث يتطفـل أساسـاً وبالإشـتراك مع نـوع *Hyalomma impeltatum* على الجمال، ولقد دلت الدراسة الحالية وكذلك خلال المشروع البحثي الخمسي على أن مناطق جيزان ونجران هي المناطق الرئيسة لتواجد هذا النوع من القراد في المملكة العربية السعودية.

كما وأوضحت الدراسة أن نوع *Rhipicephalus turanicus* موجود على الأغنام والماعز في مناطق المدينة المنورة ومكـة المكرمـة وعسير، كـما تمثل هـذه المناطق امتـداداً غربيـاً وجنوبياً لمناطق انتشاره الرئيسة في الجـزيرة العـربية ألا وهي منـاطق المملكة الشرقيـة والشمالية. كما وأن جبال السروات خاصة في منطقة مكة المكرمة هي الديار الأساسيـة في المملكة.لنوعي قراد كانا أساساً يتطفـلان على المـاعز الجبـلي النوبي وهمـا *Hyalomma arabica* و *Boophilus kohlsi*، ونـظراً لقلة أعداد عـائلها الأصـلي أصبحت تتطفـل عـلى الماعز الأليف. ولقد أوضحت الدراسة الحالية أن منطقـة جيزان هي المنـطقة الـرئيسة لإنتشـار نوع *Hyalomma anatolicum anatolicum* في المملكـة العـربيـة السعـوديـة حيث تتطفل أنـواعه البـالغة أسـاساً عـلى الأبقار والأغنـام، أما نـوع *Hyalomma anatolicum excavatum* فقد وجد بكميات قليلة في منطقة الدراسة حيث أن مناطق انتشاره الرئيسة في المملكـة هي الشرقية والـوسطى والشـمالية، حيث يتـطفـل أسـاسـاً عـلى الجـمال والأغنـام. وفي بحث سـابق (أنـظر ديـاب وآخـرون، تحت النشر) وضحت الأهميـة الطبية والبيطرية لهذه الأنواع المحلية من القراديات.