










## Investigation of the principal vectors of abortive diseases in one-humped camels (*Camelus dromedarius*)

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### Abstract

One-humped camels (*Camelus dromedarius*) are important source of meat, milk and leather production for humans in southern Algeria. Camel livestock farming is confronted with several obstacles, including abortive diseases which can be transmitted mainly by ticks. The study was carried out in Ouargla region, South Algeria, between January and December 2017. The objective of this study was to identify ticks in camels and to study the relationship between camel abortion rate and the presence of different species of ticks. A total of 350 camels (including 171 males and 179 females) was used in this study. Ticks were searched on the entire camel body (head, neck, hump, abdomen, forelegs, back legs, and tail area). Results showed that 215/350 (61.4%) camels were infested by ticks including 137/171 (80.1%) and 78/179 (43.6%) males and females, respectively. A total of 46/179 (25.7%) camel females had aborted and all these were revealed infested by ticks. A total of 298 ticks was collected including the following species *Hyalomma dromedarii* (90.9%), *Hyalomma impeltatum* (5.37%) and for the first time in Algeria, *Amblyomma variegatum* (2.35%) and *Rhipicephalus turanicus* (1.34%). *H. dromedarii* was the most frequent ( $p < 0.001$ ). The study showed that the dromedary was highly infested by ticks. The presence of ticks in all aborted female camels certainly indicates their important role in one-humped camel abortions in Algeria. The identification of tick-borne abortive agents in camels is important in order to establish an effective abortion control plan.

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### Introduction

Ticks are a worldwide major group of arthropod vectors that can transmit different types of pathogens with impact on human and animal health. They may be observed in highly varied habitats, from the driest to the most humid (1). Pathogens transmitted among animals by arthropod vectors, mainly ticks, have been responsible for significant morbidity and mortality worldwide (2-6). Abortions have been suggested as the main causes of reproductive failure and

infertility of camels and its rates ranging from 10% to over 70% in some areas (7,8). In camels, tick-borne pathogens that can cause abortion include *Coxiella burnetii* (9,10), *Theileria* (11) and *Anaplasma* (12-14). The vector of abortive pathogens is a hematophagous arthropod that allows the active or biological transmission of these pathogens between vertebrates. Ticks are the most important vectors of vector-borne abortive diseases in terms of animal health (1,3-6). In Algeria, the total number of camels was estimated at 344 015 with majority of them is in the Sahara Desert (15).

Camels represent a definite economic interest in Sahara Desert, and remain main source of animal protein for the Saharan population (16). Parasitic diseases are a major pathological disease of the Algerian camels, in particular tick infestation (17,18). Limited information is available concerning abortion in camels that are associated to ticks in Algeria. Therefore, this study was carried out, in Ouargla region, southern Algeria, to study the relationship between camel abortion rate and the presence of different species of ticks known as vectors of abortive pathogens in camel farms.

## Materials and methods

### Study Animals

The study used 350 camels (included 171 males and 179 females) located in Ouargla region, southern Algeria (Longitude 5°19'30" E, Latitude 31°56'57" N and altitude 138m) that is characterized by an arid Saharan climate, rainfall of less than 100mm per year and average temperatures exceeding 40°C (15). Over a period between January and December 2017, ticks have been inspected throughout the animal's body, particularly at thin skin areas (ears, testicles, udders, inguinal region). Only one tick sample was collected from each animal. Four camel age categories (in years) were considered in this study: <1, 1-4, 5-8, and >8. The aborted females were identified by seeing the aborted fetus during our visit.

### Laboratory diagnosis

Ticks were collected and stored in vials containing 70° alcohols, and were identified under a binocular loupe using the key of Walker *et al.* (19).

## Statistical analysis

The statistical program used was R i386 3.0.2 for Windows GUI front-end. Chi-square test was applied to compare the tick infestation rate in camels with regard to abortion, sex, age, and season. It was also used to compare between the proportions of different tick species. The threshold value of different tests was  $P < 0.05$ .

## Results

A total of 215/350 (61.4%) camels was infested by ticks, including 137/171 (80.1%) and 78/179 (43.6%) males and females, respectively. Camel male was almost five times ( $OR=5.22$ ) more likely to be infested by ticks than female camel (Table 1). A number of 46/179 (25.7%) female camels have aborted and all of them 100% were infested by ticks. However, only 32/133 (24.1%) of non-aborted camels were infested by ticks (Table 1). Ticks were more prevalent in summer and in camels aged 1-4 years (Table 1). A total number of 298 ticks were collected, including 70 Larvae and 228 adults. Also, 240 and 58 ticks were males and females respectively. The identification of tick species revealed *Hyalomma dromedarii* Koch, 1844 (90.9%), *Hyalomma impeltatum* Schulze and Schlotzke, 1930 (5.37%) and for the first time in Algeria, *Amblyomma variegatum* Fabricius, 1794 (2.35%) and *Rhipicephalus turanicus* Pomerantsev, 1936 (1.34%). Camels were more infested by *H. dromedarii* than other species (Table 2). A number of 46/46 (100%), 10/46 (21.7%) and 3/46 (6.52%) of aborted camels were infested by *H. dromedarii*, *H. impeltatum* and *A. variegatum* ticks respectively (Table 2). *H. dromedarii* was isolated throughout the year and *H. impeltatum* was isolated during the spring season only. *A. variegatum* and *Rh. turanicus* were isolated in summer.

Table 1: Relationship between tick's infestation and abortion in camels and other factors

Variable		N° of animals examined	N° of animals infested by ticks (%)	Odds ratio (OR) (CI; 95%)	P-value
Abortion	Yes	46	46 (100)	145.19 (47.77-441.24)	0.000
	No	133	32 (24.1)	-	
Sex	Male	171	137 (80.1)	5.22 (3.29- 8.28)	0.001
	Female	179	78 (43.6)	-	
Age (year)	< 1	113	33 (29.2)	0.12 (0.07-0.2)	0.001
	1-4	181	170 (93.9)	42.59 (24.11-75.23)	
	5-8	30	7 (23.3)	0.16 (0.07-0.35)	
	> 8	26	5 (19.2)	0.15 (0.06-0.36)	
Season	Winter	109	32 (2.4)	0.13 (0.08- 0.21)	0.001
	Spring	63	35 (55.6)	0.74 (0.42- 1.29)	
	Summer	98	93 (94.9)	19.82 (9.55-41.12)	
	Autumn	80	55 (68.8)	1.51 (0.89-2.56)	

Table 2: Proportion of tick species collected from camels in the Oued Souf region

Tick species	N° ticks collected	Proportion (%)	N° infested aborted camels (%)
<i>Hyalomma dromedarii</i>	271	90.9*	46 (100)*
<i>Hyalomma impeltatum</i>	16	5.37	10 (21.7)
<i>Amblyomma variegatum</i>	7	2.35	3 (6.52)
<i>Rhipicephalus turanicus</i>	4	1.34	00
Total	298	100	

\* These values are significantly higher than the other values in the same column at  $P < 0.05$ .

## Discussion

Various bacterial and parasitic diseases have been reported to be the major problems affecting camels (20-22). Ticks are one of the most important parasites affecting the health, productivity and performance of camels by transmitting various pathogens, blood loss and irritation (19,23). In this survey we compared between the abortion rate of female camels and the presence of ticks. Four tick species were identified *Hyalomma dromedarii* 90.9%, *Hyalomma impeltatum* 5.37% and for the first time in Algeria, *Amblyomma variegatum* 2.35% and *Rhipicephalus turanicus* 1.34%. All aborted camel females have been infested with these ticks except *Rh. turanicus*. A total number of 215/350 (61.4%) camels were found infested by ticks in our study. This prevalence was in agreement with the findings of Moshaverinia and Moghaddas (24) in Iran and Onyiche *et al.* (25) in Nigeria. On the other hand, our result is lower than that reported by Kiros *et al.* (26) in Ethiopia and Lawal *et al.* (27) in Nigeria. Compared to sex type, camel's males were found to be significantly more infested by ticks than females which are in concordance with Kiros *et al.* (26). Ticks were present on camels throughout the year in our study, which is consistent with the findings of Faye *et al.* (28) and Qamar *et al.* (29). On the other hand, ticks were more prevalent in summer in our study, which is in concordance with Moshaverinia and Moghaddas (24), Elias *et al.* (30), Qamar *et al.* (31) and Fard *et al.* (32). This is due to the seasonal activity of ticks which is maximal in summer (19) for the tick species found in our study. *H. dromedarii*, is the most *Hyalomma* spp. parasitizing camels (33). In our study, camels were detected more infested by *H. dromedarii* than other species which is in concordance with Al-Deeb *et al.* (18) in United Arab Emirates, Alanazi *et al.* (34) in Saudi Arabia, and other parts of the world (21,23,26,27,35). *H. dromedarii* has an important role in the transmission of pathogens as *Theileria* (36), *Rickettsia* (19), *C. burnetii* (14), *Anaplasma* (12,13) and viruses (37) of which some may be abortive. In our study, *H. dromedarii* ticks were observed in all abortive camel females which lead us to suspect their potential role in abortions in camel farms.

*H. dromedarii* is the most tick observed on camels which may be related to the adaptation of this type of tick to the hot and dry climate of the Sahara, knowing that it can perform several cycles during the year (19,38). The assembling of

camels around the water points of the oases facilitates their infestation, as the oases offer a favorable microclimate for ticks, particularly of the genus *Hyalomma* (18), which have long legs and actively move in search of the camels (19). *H. impeltatum* shares similar hosts and geographical areas with *H. dromedarii* (19). It has been revealed as a vector for *Theileria annulata*, an abortive agent in cattle (39). *Theileria* infection was reported in camels in United Arab Emirates (40) and in Saudi Arabia (34). *Theileria* infection was reported in camels suffered from symptoms included abortion (34). In our study, all ticks of *H. impeltatum* were observed on abortive camels which lead us to suspect their potential role in these abortions. The number of *H. impeltatum* ticks collected was 16/298 (5.37%) which is in concordance with the finding of Elghali and Hassan (35) and higher than the results of Moshaverinia and Moghaddas (24). This difference in the rate of prevalence can be attributed to different climatic conditions, sample size and particularly differences in the sampling periods (24). In our study, *A. variegatum* was isolated for the first time in Algeria from camels with a percentage of 2.35% of all collected ticks. This result is consistent with the data provided by Hassan *et al.* (36), in Egypt, Zeleke and Bekele (41) and Kiros *et al.* (26), in Ethiopia. *A. variegatum* ticks are considered one of the most important tick species present in Africa (19,42). It can result in severe economic losses due to milk production reduction and death of livestock (43). It has been implicated as a vector of *Ehrlichia ruminantium*, heartwater disease (44) and *Dermatophilus congolensis*, dermatophilosis (45). It also transmits *Ehrlichia bovis*, causing bovine ehrlichiosis, and the protozoans *Theileria mutans* and *Theileria velifera* causing benign bovine theileriosis (19). *Rh. turanicus* is a typical *Rhipicephalus* of livestock and Kiros *et al.* (26). In our study, *Rh. turanicus* were less prevalent, representing 1.34% of the ticks found, which is similar to the study described in Saudi Arabia by Alanazi *et al.* (11) and in Iran by Moshaverinia and Moghaddas (24).

## Conclusion

This preliminary survey provides valuable baseline data on the tick species of one humped camels, their distribution and their potential role in abortion of female camels in Ouargla region, southern Algeria. *H. dromedarii* was the

most abundant tick and the report of *A. variegatum* and *Rh. turanicus* for the first time in Algeria requires particular attention, especially for public health. In the next step, it is necessary to identify the abortive agents vectorized by these ticks in order to establish an effective control plan.

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### Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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## التحقيق في النواقل الرئيسية للأمراض المجهضة في الإبل ذات السنم الواحدة (*Camelus dromedarius*)

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### الخلاصة

تُعدّ الإبل ذات السنم الواحد مصدراً مهماً لإنتاج اللحوم والألبان والجلود للإنسان في جنوب الجزائر. تواجه تربية الإبل عقبات عديدة، لاسيما أمراض الإجهاض التي يمكن نقلها خاصة بالقراد. الهدف من هاته الدراسة هو التعرف على القراد الموجود عند الإبل ودراسة العلاقة بين مستوى الإجهاض وتواجد القراد. أجريت دراستنا في منطقة ورقلة جنوب الجزائر في الفترة ما بين يناير وديسمبر ٢٠١٧. العدد الكلي هو ٣٥٠ جمل (منها ١٧١ ذكر و ١٧٩ إناث) تم استعمالها في هاته الدراسة. تم تفتيش القراد على كامل جسم الإبل (الرأس والرقبة والسنم والبطن والأرجل الأمامية والساقين الخلفية ومنطقة الذيل). أظهرت النتائج أن ٣٥٠/٢١٥ (٤٦,٤٪) من الإبل مصابة بالقراد منها ١٧١/١٣٧ (٨٠,١٪) و ١٧٩/٧٨ (٤٣,٦٪) ذكور وإناث على التوالي. وقد عانت ١٧٩/٤٦ (٢٥,٧٪) من الإبل من الإجهاض وكانت جميعها بمصابة بالقراد. تم جمع ٢٩٨ من القراد شملت أنواعها ٩٠,٩٪ *Hyalomma dromedarii* و ٥,٣٧٪ *Hyalomma impeltatum* وللمرة الأولى في الجزائر ٢,٣٥٪ *Amblyomma variegatum* و *Rhipicephalus turanicus* ١,٣٤٪. كان لأكثر تواجداً. لقد أثبتت الدراسة أن الجمل مصاب كثيرا بالقراد. إن وجود القراد في جميع الإبل المجهضة يشير بالتأكيد إلى دورها الهام في نقل مسببات الأمراض المجهضة في الإبل ذات السنم الواحد في الجزائر. لذلك من المهم تحديد عوامل الإجهاض التي تحملها القراد في الإبل من أجل وضع خطة فعالة لمكافحة الإجهاض.