ISSN:2958-0420 Contents lists available at JJOAS-N

Jordan Journal of Applied Science - Natural Science Series
Applied Science Private University

Research Article *Vol. 19*

First Report of the Ectoparasite Haemaphysalis parva Tick Infestation on Domestic Animals in Libya's North-east Coast.

Samira S. Garboui[1*], Fawzeia H. Elmhalli[1], Giulio Grandi[2].

[1]Department of Infectious Disease, Public Health Faculty, University of Benghazi, Libya.

[2]Department of Biomedical Sciences and Veterinary Public Health, Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden.

ARTICLE INFO

Article history:

Received 22 Sep 2024

Accepted 03 Feb 2025

Published 29 Apr 2025

DOI: https://doi.org/10.35192/jjoas-n.v19i1.2003

***Corresponding author:**

Department of Infectious Disease, Public Health Faculty, University of Benghazi, Libya

Email: Samira.garboui@uob.edu.ly.

ABSTRACT

Background: Ticks are critical vectors of pathogens impacting human and animal health. As such, precisely identifying tick species is essential to outline their geographic distribution and the disease-causing agents they transmit. Despite this critical need, comprehensive data on tick populations in Libya remains incomplete, limiting efforts to evaluate zoonotic risks and implement targeted public health measures. This study aimed to identify hard tick species infesting domestic animals in sites randomly selected on Libya's northeastern coast.

Methods: Between December 2017 and May 2018, ticks were collected from ground habitats (farms, forests) and 61 domestic animals (sheep, goats, cows, and dogs) across six sites in Benghazi and the Green Mountain region. Ticks were carefully collected from the abdomen of a host using fine-tipped forceps to preserve diagnostic features, stored in 70% ethanol, and morphologically identified at Uppsala University using a stereomicroscope and taxonomic keys.

Results: Out of 138 ticks analyzed, four species were identified: Rhipicephalus sanguineus (68.5%, n = 98), Rhipicephalus bursa (7.6%, n = 11), Hyalomma franchinii (6.2%, n = 9), and Haemaphysalis parva (13.9%, n = 20). The discovery of H. parva represents a novel finding, indicating its potential presence as a vector for tick-borne diseases in Libya.

Conclusion: This study expands the knowledge of tick diversity in Libya, particularly highlighting the newly documented H. parva. This finding highlights the need for expanded surveillance to assess its role in pathogen transmission and inform public health strategies in Mediterranean ecosystems.

Keywords: Ixodidae ticks, Ectoparasite, H. parva, Northeastern Libya.

Introduction

Hard ticks are widely distributed throughout North Africa, encompassing countries such as Morocco, Algeria, Tunisia, Libya, and Egypt (1). The distribution of hard ticks in North Africa is influenced by climate, vegetation, and the presence of suitable hosts. Among the hard tick species found in North Africa, those belonging to Haemaphysalis are particularly significant (1). Studies indicate that climate change is impacts the distribution patterns of tick species like Haemaphysalis spp., leading to potential expansions in suitable habitat areas due to changing environmental conditions (2, 3). These ticks are important vectors for various pathogens affecting human health, and their distribution is tightly interlinked with climate changes. The effect of climate change on the environmental suitability of Haemaphysalis ticks is evident in the expansion of suitable areas in Mediterranean countries, southeast central Europe, and the Balkans, highlighting the need for further exploration of risk areas for these ticks and associated pathogens (4). Although countries such as Greece, Turkey, Iran, and southern regions of Italy and Lebanon have documented tick populations, the prevalence remains comparatively lower (5; 6;7; 8;9).

Prior to World War II, studies on animal parasitology in Libya was conducted by Italian investigators (10;11). They specifically investigated the presence of various tick species native to Libya and their association with specific diseases. Their investigations revealed the presence of Ornithodoros foleyi, as the vector responsible for transmitting tick bite fever (12), O. tholozani, as the vector for relapsing fever (13), and R. sanguineus as the vector for boutonneuse fever (14; 11). These studies provided evidence for the existence of 14 native tick species in Libya. During a comprehensive survey conducted over four years in Libya, Beesley and Gabaj in 1991, identified tick species infesting livestock. Their research identified the presence of R. bursa, R. microplus, and R. decoloratus (15). It is worth noting that R. bursa was previously reported in Libya in 1901 but was later deemed an incorrect identification by Donitz in 1905 (16). Studies in Libya has revealed the presence of thirteen ixodid and two argasid tick species. H. dromedarii was identified as the most prevalent species (17;18). In a previous study

Published by Jordan Journal of Applied Science - Natural Science Series — This is an open access article under the CC BY 4.0 license.

in the northeastern coast (Jabal Al Akhdar) of Libya, between 2006 and 2009, 11 types of hard ticks were identified (19). Fifteen species have been documented in Libya (1), and this was the latest documentary about Libyan ticks with no evidence of the presence of H. parva during all these studies. A study conducted in Tarhuna, Libya reported the presence of four tick species infesting livestock: Hy. dromedarii, Rh. bursa, Hy. excavatum, and Rh. camicasi (20). However, research on ticks in the country has since been insufficient.

The study aims to provide new insights into the diversity and distribution of tick species in Libya, especially since H. parva had not been previously reported in the country. Given their significant role as disease vectors, it is crucial to urgently evaluate their potential impacts on human and animal health. These events are expected to become more frequent with climate change.

Materials and Methods

Study area

Tick samples were collected in December 2017, March 2018, and May 2018, from Benghazi and the Green Mountain (Al-jabal Al-akhdar), on the northeastern coast of Libya. From Massah, it is located 10 km west of Beida (32° 45' 7" North, 21° 37' 36" East), El-Beida (32° 45' 59" North, 21° 44' 30" East, Shehat (32° 49' 40" North, 21° 51' 44" East), Safsaf, 7 km south of Shahat (Cyrene), and Girnada, a village, south of the city of Shahat, about 12 km (figure 1) (21).

The Green Mountain Coast (Al Jabal Al Akhdar) is a rocky area with terra rosa soil or heavy clay frequently intercepted by wadis (valleys). It has a Mediterranean climate characterised by warm summers and mild winters compared to colder temperatures. Rainfall is typically limited; its average ranges between 250 and 600 mm and occurs mainly during winter (21).

Tick Collection

Ticks were collected from randomly selected sites across two main environments: ground habitats (e.g., farms and forests) and 61 animals, including sheep, goats, cows, and dogs. Ticks were carefully removed from visibly abundant clusters on the abdominal regions of host animals. Clean, fine-tipped forceps were used to grasp each tick as close to the skin surface as possible, followed by gentle upward extraction using steady, even pressure. Special care was taken to preserve the integrity of the mouthparts during removal, as these structures are essential for accurate taxonomic identification. All ticks collected from a single host were stored individually in labelled 5-mL plastic vials containing 70% ethanol for preservation. The vials were refrigerated at a controlled temperature to minimize degradation until subsequent processing.

Taxonomic Identification

The preserved tick specimens were transported to Uppsala University in Sweden. Upon arrival, each specimen was individually examined under a stereomicroscope (Olympus SZX16, Tokyo, Japan) and identified to the family, genus, species, and sex levels using established taxonomic keys. Morphological identification was based on key characteristics such as body shape, scutum patterns, mouthpart structures, and other diagnostic features. This systematic classification ensured accurate taxonomic placement of the ticks, supported by references to standardized criteria (22, 23, 24, 25, 26).

Statistical Analysis

Statistical analysis was conducted using SPSS Version 27. The data analysis included descriptive and inferential statistics. Descriptive statistics were used to summarise frequencies and percentages. In inferential statistics, a chi-square test was used to evaluate the association between tick species and sampling sites, and a chi-squared test for independence was utilised. This non-parametric test is appropriate for categorical data and assesses whether the observed distribution of tick species significantly deviates from what would be expected under the assumption of independence. Specifically, a p-value ≤ 0.05 was considered to indicate statistical significance.



Figure1. Map of Libya showing sampling sites (21).

Results

Tick collection and species identification

One hundred thirty eight tick samples from sex study locations were properly examined in this study using a stereomicroscope and taxonomic keys. Of these tick samples, 78 were individual male adults and 66 were individual female adults. Overall, the ratio of male to female ticks was 1.4:1. Four tick species were detected namely: Mediterranean ear tick, H. parva (n = 20, 13.9%), being recorded for the first time in Libya. The most common tick species were Rh. sanguineus (n = 98, 68.5%), Rh. bursa (n = 11, 7.6%), and Hy. franchini (n = 9, 6.2%) (Table 1). Statistically, there is a highly significant association, as indicated by the P-value (0.00079), underscoring the influence of site-specific factors on species distribution. By incorporating this analysis, the study provides robust statistical support for its findings.

Morphological Characteristics Differentiating *H. parva* from Other Tick Species

A Mediterranean ear tick, *H. parva* represents the first recorded occurrence in Libya, with distinct morphological features confirming its taxonomic differentiation from regional congeners as shown in Table 2 and Figure 2.

Morphological Characteristics Differentiating *H. parva* from Other Tick Species

A Mediterranean ear tick, *H. parva* represents the first recorded occurrence in Libya, with distinct morphological features confirming its taxonomic differentiation from regional congeners as shown in Table 2 and Figure 2.

Table 2. Morphological Features of H. parva Compared to Other Species of Haemaphysalis.

Morphological Feature	Description in *H. parva**	Comparison to Regional *Haemaphysalis* *
Gnathosoma	Small in size; pseudoscutum absent.	Larger gnathosoma; pseudoscutum present in most congeners.
Lateral Palpal Segment 2	Wider than the basis capituli.	Narrower than basis capituli in regional species.
Palp Article 2	Lacks a dorsal spur; lateral segment angled but not significantly extended.	Often bears a dorsal spur; lateral segment more elongated.
Palpal Segment 3	Straight and lacks a pincer-like shape.	Typically curved or pincer-shaped in other species.
Spiracular Plates	Large plates positioned posterior to leg IV.	Smaller spiracular plates in most regional ticks.
Anal Groove	Round-shaped.	V-shaped in other *Haemaphysalis* spp.
Coxae I Spur	No gap present in the spur.	Often exhibits a gap in the spur.
Coxae IV Spur	Short, not exceeding the length of coxae I-III.	Longer spurs in coxae IV compared to I-III in regional ticks

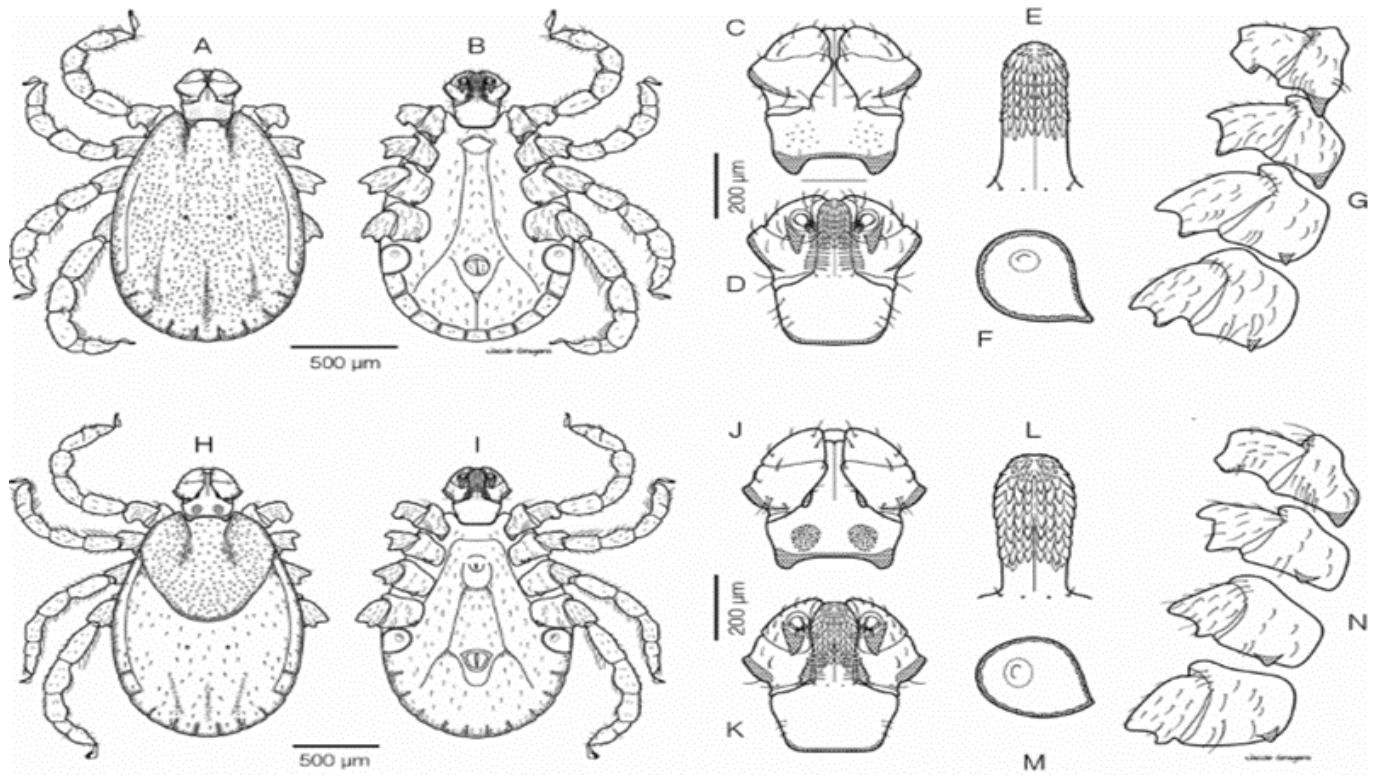

Figure 2. The features of a Mediterranean ear tick, *H. parva*, Adult male. A dorsal view, B ventral view and adult female H dorsal view, B ventral view.

Discussion

The identification of *H. parva* in Libya represents a novel finding, as this species had not been previously documented in the country. *H. parva*, commonly referred to as the Mediterranean ear tick, is known to infest a variety of mammalian hosts, including domestic animals and wildlife, and is recognized for its role as a potential vector of tick-borne pathogens (8). This species is primarily established in the Mediterranean region (26), and its presence in Libya is not unexpected, given the country's proximity to the Mediterranean Sea and its role as a stopover for migratory birds traveling between Europe and Africa, where this tick species is also found. Factors such as climate, host availability, and migratory bird patterns likely influence the occurrence of *H. parva* in Libya. Although a review article suggested that certain studies recorded the presence of *H. parva* in Libya, a thorough examination of the cited sources reveals no explicit mention of this species (1).

Parva is typically found in countries such as France, Italy, Spain, Portugal, Greece, and Turkey (6, 8). The Green Mountain region (Jabal Al Akhdar), where *H. parva* was identified, shares climatic similarities with other Mediterranean areas where this species is prevalent, such as Turkey and Greece. The current distribution of *H. parva* is expanding across Mediterranean countries, southeast central Europe, and the southern Balkans (26), suggesting that its range may continue to grow, thereby increasing the risk of tick-borne diseases in these regions.

Several studies have highlighted the potential of *H. parva* to transmit various pathogens. For instance, research in Greece emphasized its role in the potential transmission of novel tick-borne phleboviruses (27). Another study in Turkey documented the incidence of ovine piroplasmosis and *Theileria annulata* in cattle, with *H. parva* among the implicated tick species (28). While *H. parva* is primarily known to infest animals, a study in Lebanon reported the first documented case of *H. parva* ticks infesting humans in the region (9). Additionally, Keskin et al. (2015) demonstrated its ability to transmit tick-borne pathogens to humans, including Borrelia burgdorferi, Rickettsia hoogstraalii, and the Crimean-Congo hemorrhagic fever (CCHF) virus (29).

The brown dog tick, *Rh sanguineus*, was the most prevalent species identified in the study sites, a finding consistent with previous studies (11; 19). As a widespread tick species globally, *Rh. sanguineus* primarily parasitizes dogs but can also infest humans and other hosts. Importantly, this species is a known vector for various disease-causing agents, including *Coxiella burnetii, Ehrlichia canis,*and *Rickettsia conorii,* (1). *Rh. bursa* was rarely observed in the study sites. This species has been previously reported in northwestern Libya, where a study on ectoparasitic ticks of domestic animals identified four tick species, including *Rh. bursa*, infesting livestock in Tarhuna city (20), as well as in northestern Libya (19) . In contrast, *Hy. francinii* was the least prevalent species in this study. It is known to be distributed across North Africa, with confirmed presence in Libya (17-19). Notably, *Hy. francinii, Rh.bursa,* and *H. parva* were not found in Benghazi, highlighting the influence of site-specific factors on tick species distribution.

The findings of this study underscore the need to expand surveillance of tick populations in Libya, particularly in light of the newly documented presence of *H. parva.* Given its role as a vector for multiple pathogens, further research is essential to assess the potential risks this species poses to human and animal health.

Conclusion

The detection of *H. parva* underscores the dynamic distribution of ticks in North Africa, likely influenced by climate shifts . In addition to three other species, there were *Rh. sanguineus*, *Rh. bursa*, and *Hy. Franchini.* This study highlights the dynamic nature of tick distributions in response to environmental and climatic changes. Future research should focus on molecular identification of tick-borne pathogens in Libya, as well as the development of targeted public health strategies to mitigate the risks associated with tick-borne diseases.

Limitation of study

The study, limited to few sites due to financial constraints, focused on ticks affecting domestic animals. This may have excluded species from other regions or wildlife. Identification relied on morphology, as genetic analysis was not feasible.

Conflict of interest

We declare that there is no duality of interest associated with this study.

Ethics

The authors confirm that the study solely focuses onthe collection of ticks and does not involve any research conducted with human participants or animals.

Acknowledgement

We would like to sincerely thank the farmers who generously granted us permission to collect ticks from their farms and animals. Our heartfelt gratitude also goes to Youssef Al-Mahli and Dr. Jumaa Abdeldaim for their invaluable support throughout the tick collection process. Furthermore, we extend our deep appreciation to Professors Thomas Jeanson and Giulio Grandi, who supervised the identification of tick species, for their invaluable expertise.

Authors declare any financial support or relationships that may pose conflict of interest in the covering letter submitted with the study.

Funding information

The authors didn't receive any financial support or funding for the research.

References

1. Perveen N, Muzaffar SB, Al-Deeb MA. Ticks and tick-borne diseases of livestock in the Middle East and North Africa: a review. Insects. 2021;12(1):83. doi:10.3390/insects12010083
2. Madder M, Berkvens D, Geysen D, Estrada Pena A. Protozoal diseases in Europe. Vet J. 2013;195(2):137-138. doi:10.1016/j.tvjl.2012.11.008
3. Keve G, Sándor AD, Hornok S. Hard ticks (Acari: Ixodidae) associated with birds in Europe: review of literature data. Front Vet Sci. 2022;9:928756. doi:10.3389/fvets.2022.928756
4. Estrada-Peña A, Venzal JM. Climate niches of tick species in the Mediterranean region: modeling of occurrence data, distri-

butional constraints, and impact of climate change. J Med Entomol. 2007;44(6):1130-1138. doi:10.1093/jmedent/44.6.1130

5. Andersson MO, Marga G, Banu T, Dobler G, Chitimia-Dobler L. Tick-borne pathogens in tick species infesting humans in Sibiu County, central Romania. Parasitol Res. 2018;117(5):1591-1597. doi:10.1007/s00436-018-5848-0
6. Bursali A, Tekin S, Keskin A, Ekici M, Dundar E. Species diversity of ixodid ticks feeding on humans in Amasya, Turkey: seasonal abundance and presence of Crimean-Congo hemorrhagic fever virus. J Med Entomol. 2011;48(1):85-93. doi:10.1603/ME10034
7. Hosseini-Chegeni A, Telmadarraiy Z, Salimi M, Arzamani K, Banafshi O. A record of Haemaphysalis erinacei (Acari: Ixodidae) collected from hedgehog and an identification key for the species of Haemaphysalis occurring in Iran. Persian J Acarol. 2014;3(3):203-215. doi:10.22073/pja.v3i3.10152
8. Vatansever Z. Haemaphysalis parva (Neumann, 1897) (Figs. 100-102). In: Estrada-Peña A, Mihalca AD, Petney TN, editors. Ticks of Europe and North Africa: a guide to species identification. Cham: Springer; 2017. p. 259-263. doi:10.1007/978-3-319-63760-0_50
9. Raad M, Azar D, Perotti MA. First report of the ticks Haemaphysalis punctata Canestrini et Fanzago, 1878, Haemaphysalis parva (Neumann, 1897) and Dermacentor marginatus (Sulzer, 1776) (Acari, Amblyommidae) from humans in Lebanon. Acta Parasitol. 2020;65(2):541-545. doi:10.2478/s11686-019-00160-7
10. Onorato R. Le miasi in Tripolitania. Arch Ital Sci Med Colon. 1922;3:14-315.
11. Hoogstraal H, Kaiser MN. Observations on ticks (Ixodoidea) of Libya. Ann Entomol Soc Am. 1960;53:445-457.
12. Franchini G, Taddia L. Febbre da punctura di zecche in Cyrenaica causata dalla Ornithodorus franchinii. Arch Ital Sci Med Colon. 1930;11:453-458.
13. Coghill NF, Lawrence J, Ballantine ID. Relapsing fever in Cyrenaica. Br Med J. 1947;1:637-640.
14. Giordano M, Nastasi A. La febbre esantematica del littorale Mediterraneo in Tripolitania. Arch Ital Sci Med Colon. 1935;16:101-185.
15. Beesley WN, Gabaj MM. New records for Rhipicephalus bursa, Boophilus microplus, B. decoloratus and Hypoderma lineatum from Libya. Med Vet Entomol. 1991;5(2):259-260. doi:10.1111/j.1365-2915.1991.tb00549.x
16. Dönitz W. Die Zecken des Rindes als Krankheitsüberträger. Sitzungsber Ges Naturforsch Freunde Berl. 1905;4:105-134.
17. Gabaj MM, Awan MA, Beesley WN. A survey of ticks on farm animals in Libya. Ann Trop Med Parasitol. 1992;86(5):543-548. doi:10.1080/00034983.1992.11812705
18. Hador AB. A survey on ticks in some surrounding farms of Al-Baida, Al-Jabel Al-Akhdar, Libya [master's thesis]. Al-Baida (Libya): Omar Al-Mukhtar University; 2015.
19. Elmhalli FH, Garboui SS. Identification and distribution of hard ticks species (Acari: Ixodidae) on the northeastern coast of Libya. Int J Sci Basic Appl Res. 2024;73(1):130-138.
20. Abdulsalam AM, Saadawi WK, Kharwat HI, Shaibi T. Species diversity of ticks (Acari: Ixodidae) in Tarhuna, Libya. Open Vet J. 2022;12(3):370-374. doi:10.5455/OVJ.2022.v12.i3.10
21. Mapcarta. Mapcarta [Internet]. [cited 2022 Aug 10]. Available from: https://mapcarta.com/13232256/Map
22. Hoogstraal H, Kaiser MN. The ticks (Ixodoidea) of Egypt: a brief review and keys. J Egypt Public Health Assoc. 1958;33(3):51-85.
23. Hoogstraal H, Wassef HY, Büttiker W. Ticks (Acarina) of Saudi Arabia: families Argasidae and Ixodidae. Fauna Saudi Arabia. 1981;3:25-110.
24. Manilla G. Acari, Ixodida. Fauna d'Italia. Vol. 36. Bologna: Edizioni Calderini; 1998. 280 p.
25. Estrada-Peña A, Bouattour A, Camicas JL, Walker AR. Ticks of domestic animals in the Mediterranean region: a guide to identification of species. Zaragoza: University of Zaragoza; 2004. 131 p.
26. Tick Identification Key [Internet]. University of Lincoln; [cited 2018 Apr 10]. Available from: http://webpages.lincoln.ac.uk/fruedisueli/FR-webpages/parasitology/Ticks/TIK/tick-key/index.htm
27. Papa A, Kontana A, Tsioka K, Saratsis A, Sotiraki S. Novel phlebovirus detected in Haemaphysalis parva ticks in a Greek island. Ticks Tick Borne Dis. 2017;8(1):157-160. doi:10.1016/j.ttbdis.2016.10.012
28. Ozubek S, Aktas M. Molecular and parasitological survey of ovine piroplasmosis, including the first report of Theileria annulata (Apicomplexa: Theileridae) in sheep and goats from Turkey. J Med Entomol. 2017;54(1):212-220. doi:10.1093/jme/tjw134
29. Keskin A, Keskin A, Bursali A, Tekin S. Ticks (Acari: Ixodida) parasitizing humans in Corum and Yozgat provinces, Turkey. Exp Appl Acarol. 2015;67(4):607-616. doi:10.1007/s10493-015-9966-4