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Research Questions

- 1) What tick species are present in Morocco?
- 2) What pathogens are associated with ticks in Morocco?
- 3) Where are we lacking data on Moroccan ticks?

Introduction

Tick-borne diseases can have lasting impacts on humans and animals in Morocco. Tick-borne diseases (TBDs) are especially concerning in Morocco where people are closely associated with animals and are exposed to multiple tick vector species (Sarih et al. 2009; Diatta et al. 2012). Animal husbandry practices can be nomadic, exposing livestock to ticks of wildlife, which can harbor a number of dangerous pathogens in Morocco (Elhachimi et al. 2021). Available data about Moroccan ticks and their associated pathogens is dispersed across many different published sources, making it difficult to assess the TBD risks to humans and animals in Morocco. To address this knowledge gap, we have compiled and curated tick surveillance data from published literature and uploaded this into WRBUs VectorMap data available to the public will enable a better understanding of the risks associated with tick-borne diseases in Morocco.

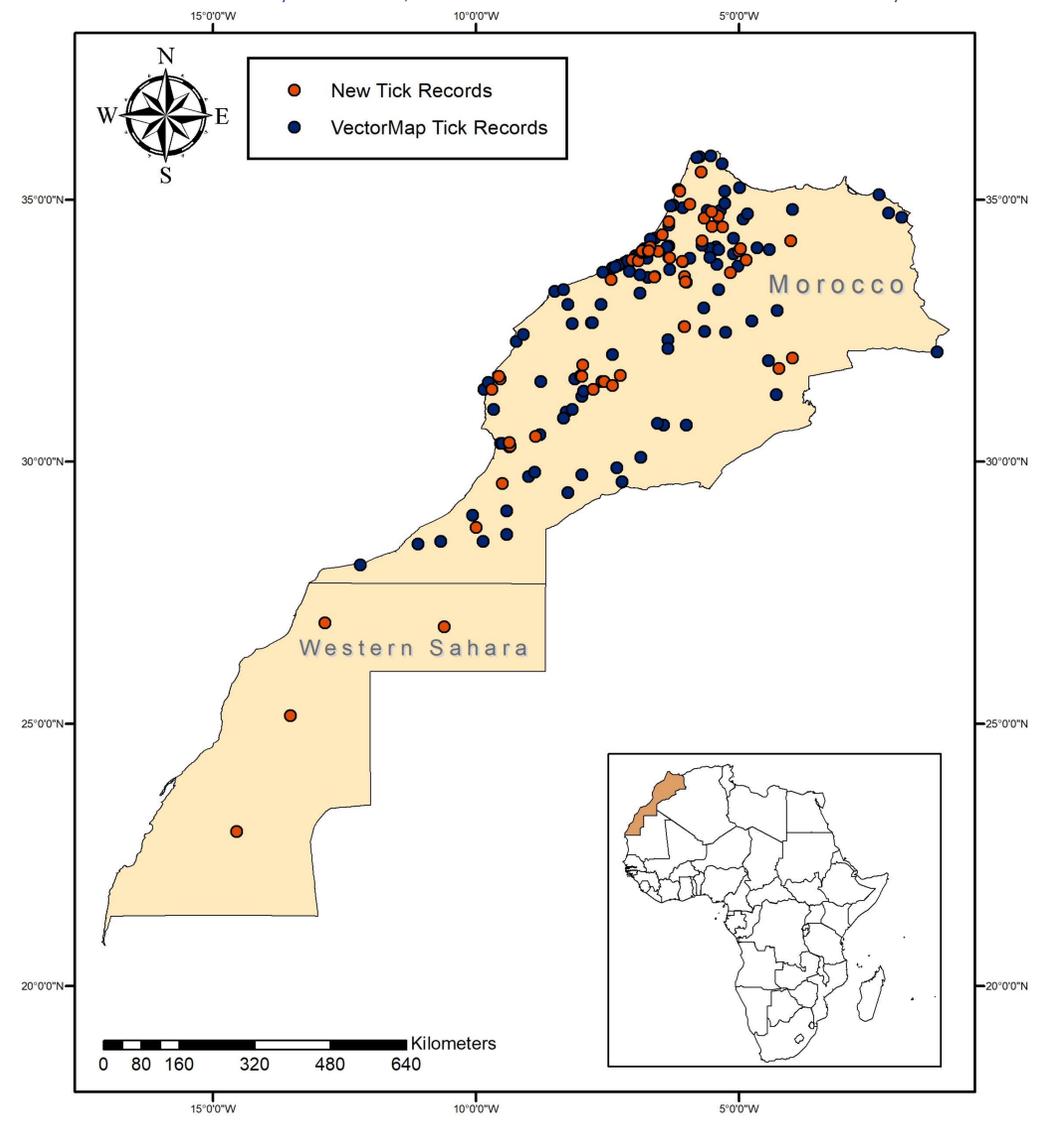


Figure 2. Map of newly gathered tick collection records along with data contained within VectorMap.

Results

- 322 articles were screened for information relating to ticks and tick-borne diseases. 136 had data relevant to our project. 59 articles were reviewed and 19 were used for data analysis.
- 19 articles documented 232 unique tick collection events, reporting 7,365 individual ticks representing 23 unique taxa (Figure 1, Figure 2).
- 86 collection events included pathogen screening results, with a total of 21 pathogens detected (Figure 3).

Discussion

This research will contribute to the scientific community in three ways: 1) Identifying risks associated with the tick-borne diseases in Morocco. 2) Determining geographic gaps in tick vector surveillance. 3) Introducing a novel way to generate surveillance data. This study has highlighted the areas of Morocco are struggling with tick-borne diseases, enabling future researchers to target these areas and allocate resources more effectively and efficiently. It also enables people to understand the risks associated with being in different locations in Morocco. Areas lacking tick collection data highlight where further research must be carried out in order to make meaningful conclusions about tick-borne diseases in the area. Finally, by mining existing data from literature, we show a novel, cost-effective way to generate high-quality data for vector modelling and risk assessments without requiring costly field work.

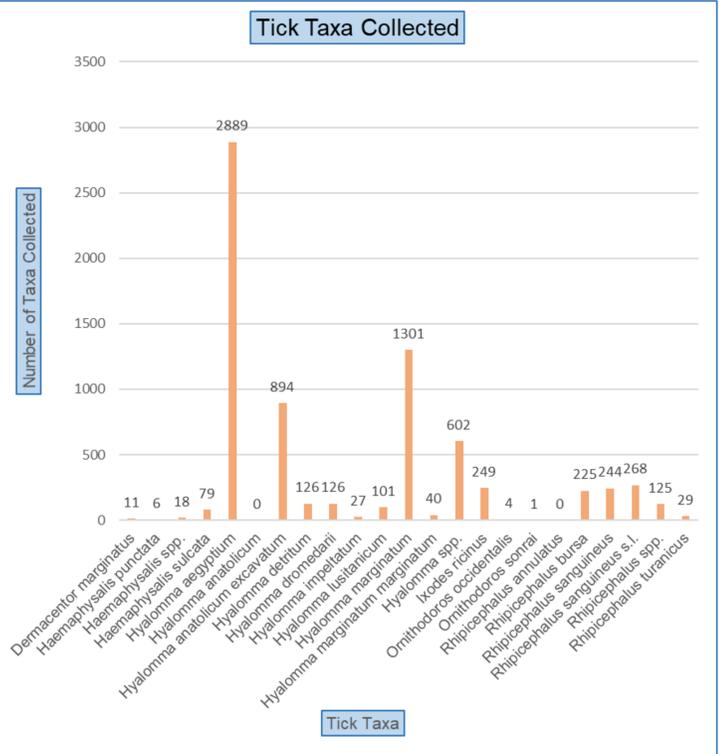


Figure 1. Graph showing number of individual tick taxa collected within Morocco.

Materials and Methods

1. Acquiring relevant information
 - a) Conducted a systematic literature review using PubMed and Web of Science library databases, targeting articles reporting studies on tick collections and tick-borne disease seroprevalence in Morocco.
 - b) Reviewed articles by titles and abstract to remove irrelevant studies.
 - c) Download article PDFs and requested inter-library loans for articles without an available PDF.
2. Extracting data
 - a) Extracted collection locality and other collection data from PDFs, including pathogen screening results.
 - b) Organized data into standardized entry form.
3. Mapping data
 - a) Georeferenced collection localities using the point radius method (Wieczorek, Guo, & Hijmans, 2004).
 - Collection records with only named localities were georeferenced using a gazetteer and the extent of the locality measured in Google Maps.
 - Collection records with coordinates used a georeferencing calculator to measure coordinate uncertainty (Wieczorek & Wieczorek, 2015).
 - b) Georeferenced data was added to VectorMap (vectormap.si.edu)..

Ticks Positive for Tick Borne Diseases

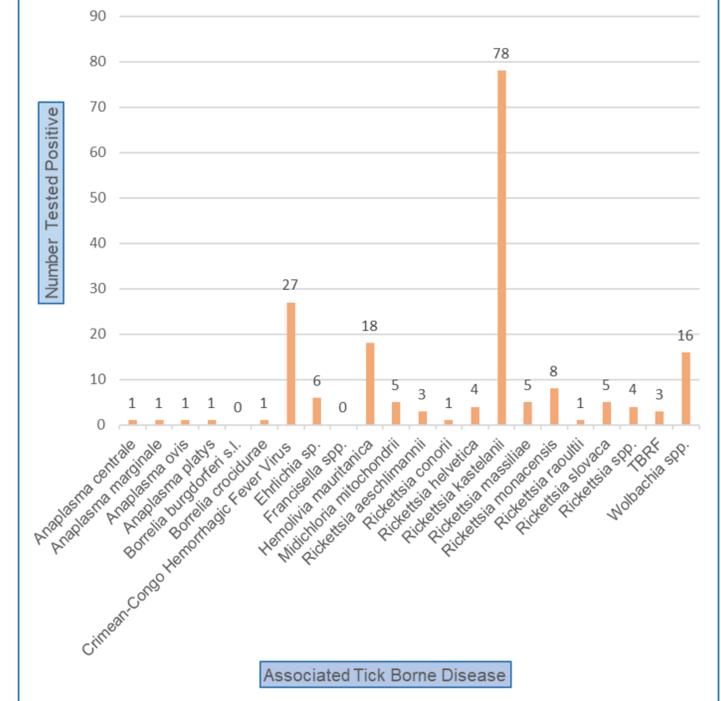


Figure 3. Graph showing number of confirmed positive pathogens found within ticks in Morocco.

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