Ticks and Tick-borne Diseases xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Ticks and Tick-borne Diseases

journal homepage: www.elsevier.com/locate/ttbdis

Short communication

# A five-year survey of tick species and identification of tick-borne bacteria in Sardinia, Italy

Valentina Chisu[a,*], Cipriano Foxi[a], Roberto Mannu[b], Giuseppe Satta[a], Giovanna Masala[a]

[a] Istituto Zooprofilattico Sperimentale della Sardegna, Sassari, Italy
[b] Istituto per lo studio degli ecosistemi, CNR, Sassari, Italy

ARTICLE INFO

*Keywords:*
*Bartonella*
*Rickettsia*
*Coxiella burnetii*
*Anaplasma*
*Ehrlichia canis*
Ticks
Sardinia

ABSTRACT

Sardinia is a hotspot for studying tick-borne diseases in the Mediterranean region, where cases of notifiable tick-borne diseases are increasing. The aim of this study was to determine the presence of tick-borne bacteria of medical and veterinary importance in ixodid ticks collected from domestic and wild animals, humans, and vegetation from different collection sites in Sardinia. Using standard PCR and sequencing techniques, the presence of *Rickettsia*, *Anaplasma*, *Ehrlichia*, and *Bartonella* species, as well as *Coxiella burnetii* was evaluated. A total of 1619 ticks were morphologically identified as *Rhipicephalus sanguineus* sensu lato, *R. bursa*, *R. annulatus*, *Dermacentor marginatus*, *Haemaphysalis punctata*, *Ha. sulcata, Hyalomma lusitanicum*, *H. marginatum*, *Ixodes festai* (sometimes referred to erroneously as *I. ventalloi*), and *Argas reflexus.* Results indicated the presence of several circulating pathogens in Sardinian ticks. DNA of *Rickettsia* species was detected in 58 out of 1619 (4%) belonging to *R. sanguineus* s.l., *D. marginatus*, *Ha. punctata*, *H. marginatum*, and *I. festai* species. *Ehrlichia canis* DNA was detected in 33 out of 1619 ticks (2%) belonging to *R. sanguineus* s.l., *R. bursa*, and *Ha. punctata* species. A total of 61 out of 1619 (4%) ticks (*R. sanguineus* s. l., *R. bursa*, *Ha. punctata,* and *I. festai*) tested positive for *Anaplasma* spp. *Coxiella burnetii* was detected in 21 out of 1619 (1%) ticks belonging to *R. sanguineus* s.l., *R. bursa*, *R. annulatus*, and *H. marginatum* species. Five *R. sanguineus* s.l. and one *R. bursa* ticks were positive for the presence of *Bartonella* sp. 16S rRNA gene. Our findings expand the knowledge on tick-borne microorganism repertoires and tick distribution in Sardinia. Tick distribution should be monitored for effective control of these arthropods and the infections they transmit.

## 1. Introduction

Ticks are hematophagous arthropod vectors responsible for transmitting a wide variety of pathogenic agents (viruses, bacteria, protozoa, and helminths) between vertebrate hosts, resulting in human and animal diseases (Jongejan and Uilenberg, 2004). In Sardinia, the second largest island in the Mediterranean Sea, notifiable tick-borne diseases are spreading (Madeddu et al., 2016) and Mediterranean spotted fever (MSF) rickettsiosis continues to be endemic with an incidence of 10/10000 inhabitants per year (ISS, 2017). Bacteria from the genera *Rickettsia* (etiological agent of rickettsioses), *Anaplasma* and *Ehrlichia* (agents of anaplasmosis and ehrlichiosis, respectively), *Bartonella* (responsible for bartonellosis), and *Coxiella burnetii* (Q fever causative agent) represent an emerging global threat (Maurin and Raoult, 1999; Parola and Raoult, 2001; Chomel et al., 2009; Ismail et al., 2010). In Sardinia, the spotted fever group (SFG) rickettsiae have been detected in ticks and humans (Madeddu et al., 2016; Chisu et al., 2017). The absence of Lyme borreliosis and *Borrelia burgdorferi* sensu lato, the commonest tick-borne bacterial pathogen in Europe, is related to the absence of the vector, *Ixodes ricinus* which occurs on the Italian mainland at the same latitude (Satta et al., 2011). This study aims to update the previous data on tick fauna infesting hosts in Sardinia (Satta et al., 2011) and evaluates the presence of *Rickettsia*, *Ehrlichia*, *Anaplasma*, *C. burnetii*, and *Bartonella* species in Sardinian ticks.

## 2. Material and methods

### 2.1. Ethics statement

All procedures performed in this study involving ticks collected from human and animals were in accordance with the ethical standards of the institutional research ethics committee of the Experimental Zooprophylactic Institute of Sardinia.

* Corresponding author.
*E-mail address:* valentinachisu@virgilio.it (V. Chisu).

https://doi.org/10.1016/j.ttbdis.2018.02.008
Received 27 July 2017; Received in revised form 6 February 2018; Accepted 7 February 2018

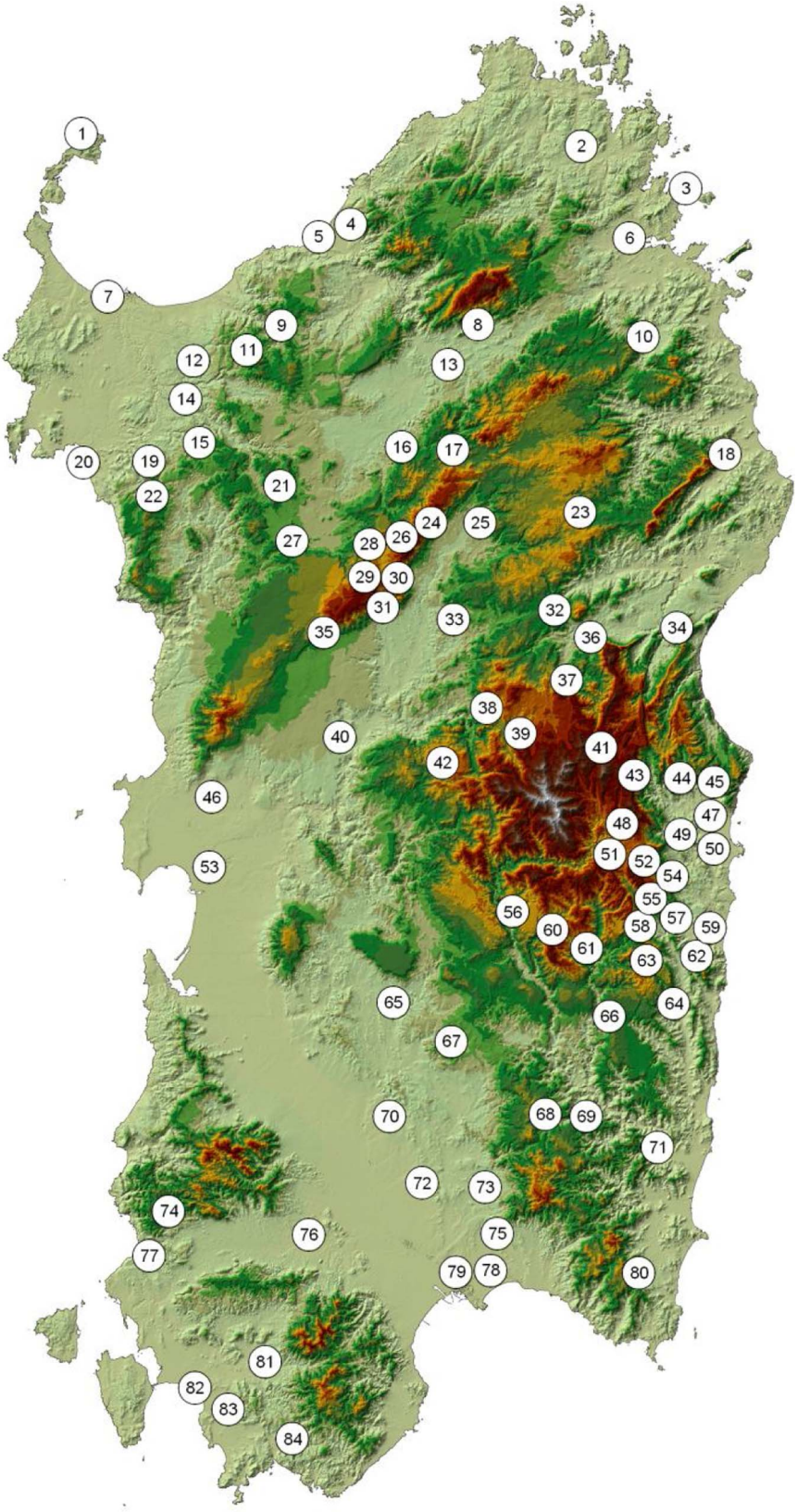


**Fig. 1.** Map of Sardinia indicating tick collection sites represented by consecutive numbers.

### 2.2. Tick collection sites

During 2010–2015, 1619 ticks were collected from domestic and wild animal hosts, humans, and vegetation from 84 collection sites on the island of Sardinia (Fig. 1). Wild animals sampled during this study were brought dead to our laboratories for necroscopy analyses and tick collection. Domestic animals were those reared on small farms and their owners provided collected ticks in 15-ml tubes. Ticks were removed