Ticks & Crimean-Congo haemorrhagic fever virus ecology to predict disease expansion

Dr. Francisco Ruiz Fons

Training workshop on emerging infectious diseases – 2026 - Istanbul

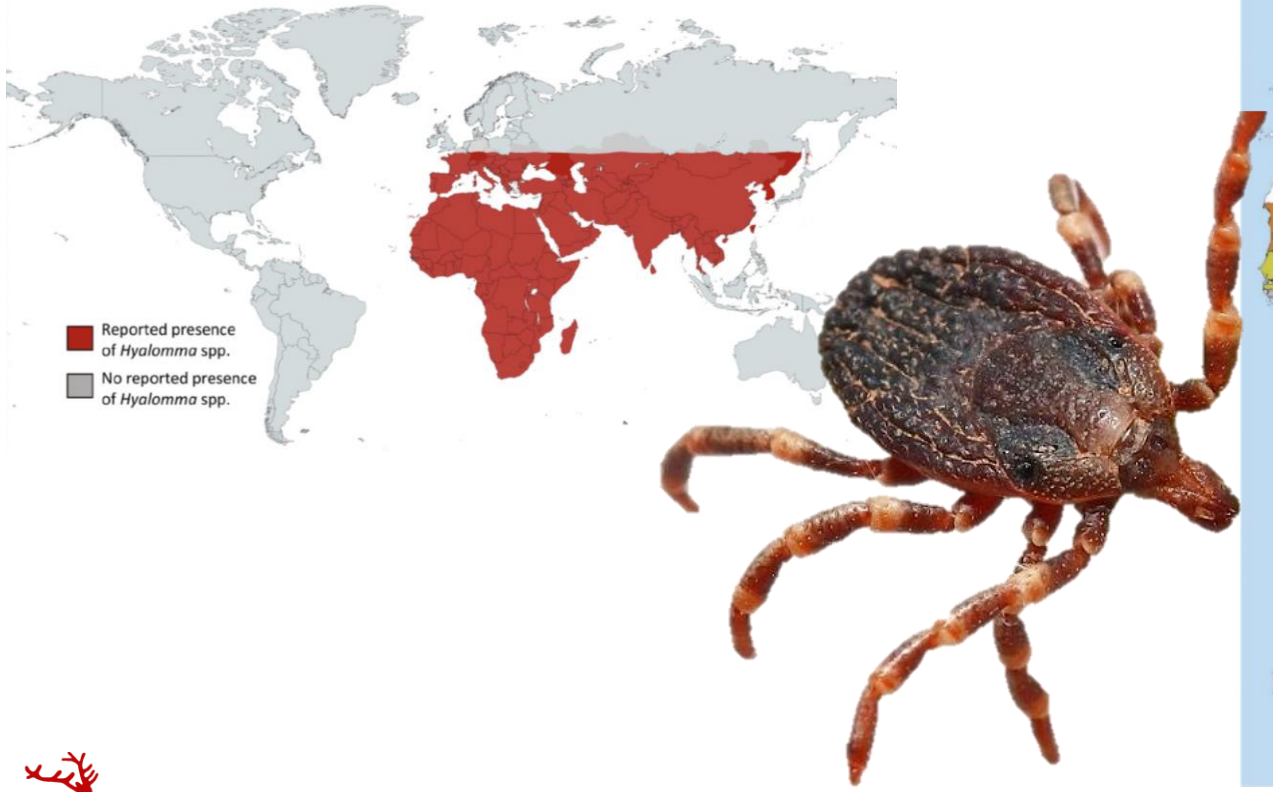
25th and 26th March

CCHFV vectors

The control of *Hyalomma* ticks, vectors of the Crimean–Congo hemorrhagic fever virus: Where are we now and where are we going?

Sarah I. Bonnet[1,2*], Gwenaël Vourc'h[3,4], Alice Raffetin[5,6,7], Alessandra Falchi[8], Julie Figoni[9], Johanna Fite[10], Thierry Hoch[11], Sara Moutailler[12], Elsa Quillery[10]

PLOS NEGLECTED TROPICAL DISEASES

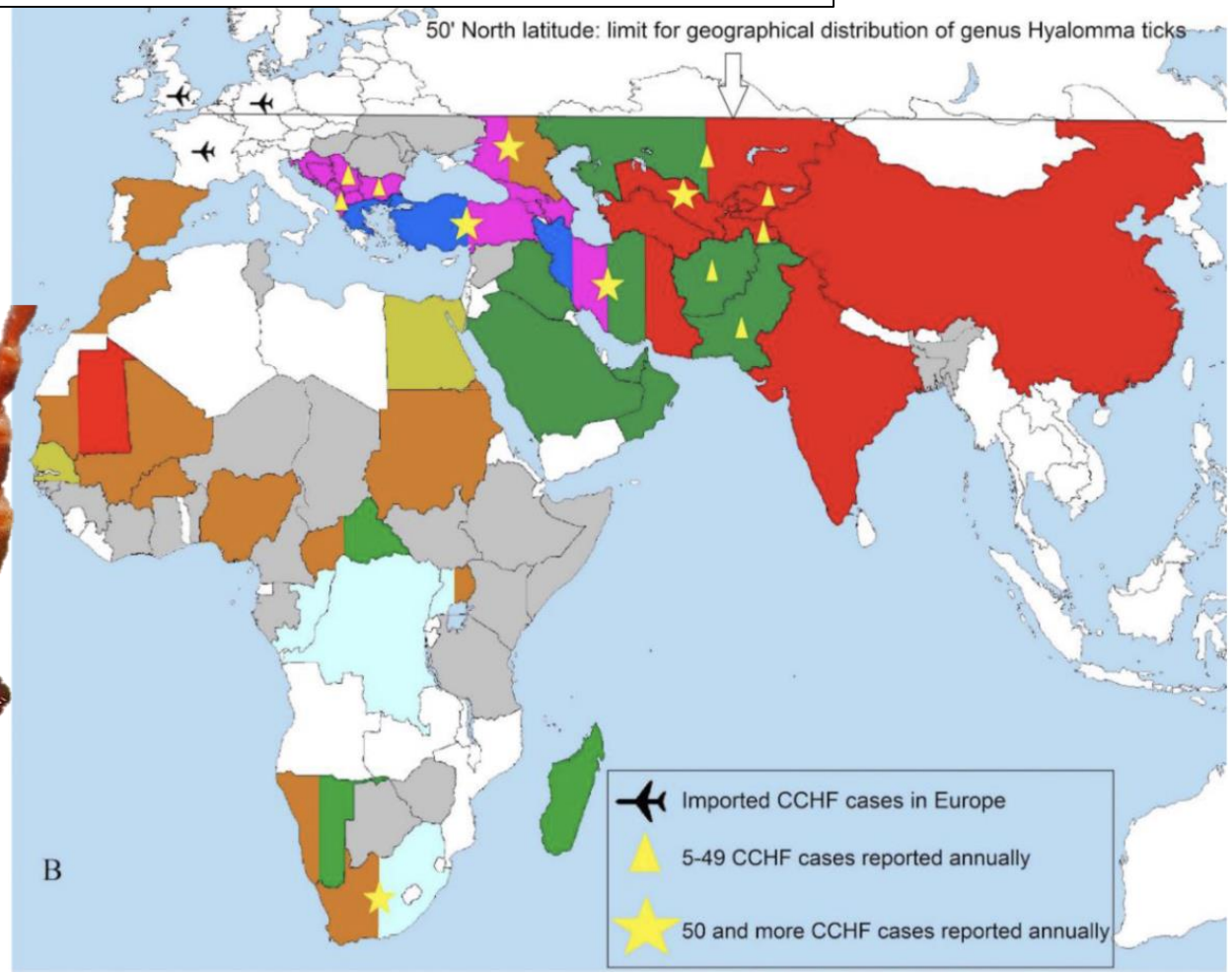


Review

Crimean-Congo Hemorrhagic Fever Virus in Asia, Africa and Europe

Microorganisms **2021**, *9*, 1907. https://doi.org/10.3390/microorganisms9091907

Nariman Shahhosseini [1,†], Gary Wong [2,3], George Babuadze [4], Jeremy V. Camp [5], Onder Ergonul [6], Gary P. Kobinger [2,7,8,9], Sadegh Chinikar [10,11,*] and Norbert Nowotny [11,12,*,†]



CCHFV vectors

PARASITOLOGY, X, 4, 1976

UDC 576.895.42: 616.981.459

THE ROLE OF IXODID TICKS IN THE TRANSMISSION AND PRESERVATION OF THE CRIMEAN HEMORRHAGIC FEVER IN THE INFECTION NIDI

B. F. Kondratenko

Experimental infection of *Hyalomma plumbeum* Panz., *Rhipicephalus rossicus* Jak. et K. Jak. and *Dermacentor marginatus* Sulz. with the virus of the Crimean hemorrhagic fever has shown that preimaginal phases of the above ticks easily receive an infection agent from the infected donor, preserve it for a long time, transmit it through a bite during feeding to susceptible animals; during metamorphosis they transmit this agent to the subsequent developmental phases as well as to the progeny of infected individuals from one generation to another.

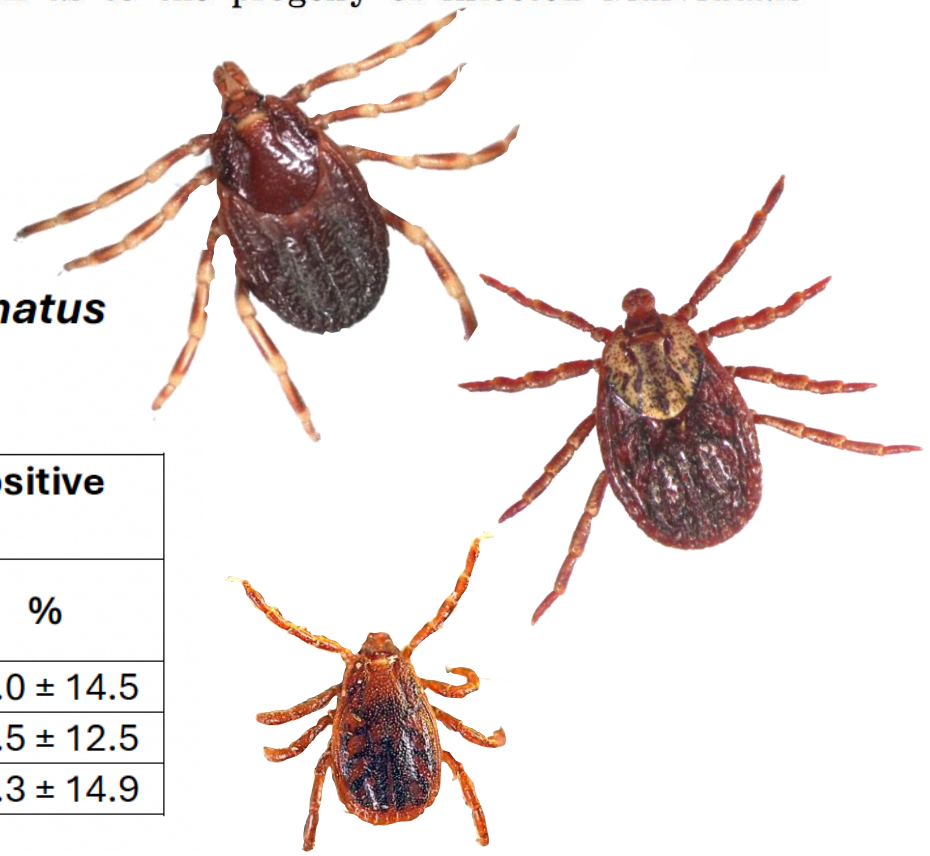


Table 3

Feeding results of infected ticks *H. plumbeum*, *R. rossicus* and *D. marginatus* on small ground squirrels and rabbits

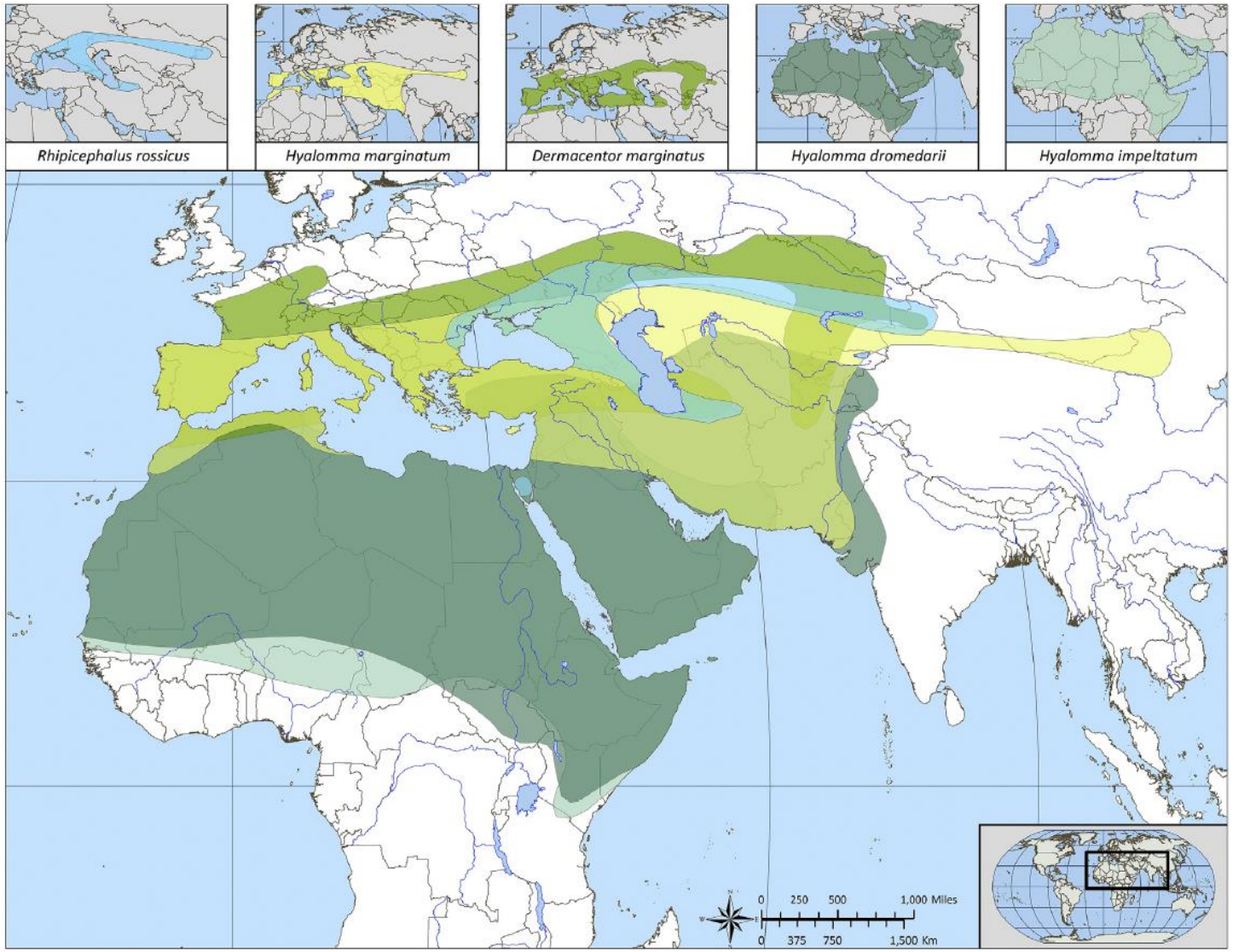
Tick species	Number of animals used in the experiments	Number of ticks per 1 animal	Total experiments	Of then with positive results	
				Number	%
H. plumbeum	10	3 to 400	10	7	70.0 ± 14.5
R. rossicus	16	5 to 400	16	10	62.5 ± 12.5
D. marginatus	12	4 to 100	12	7	58.3 ± 14.9

CCHFV vectors

The role of ticks in the maintenance and transmission of Crimean-Congo hemorrhagic fever virus: A review of published field and laboratory studies

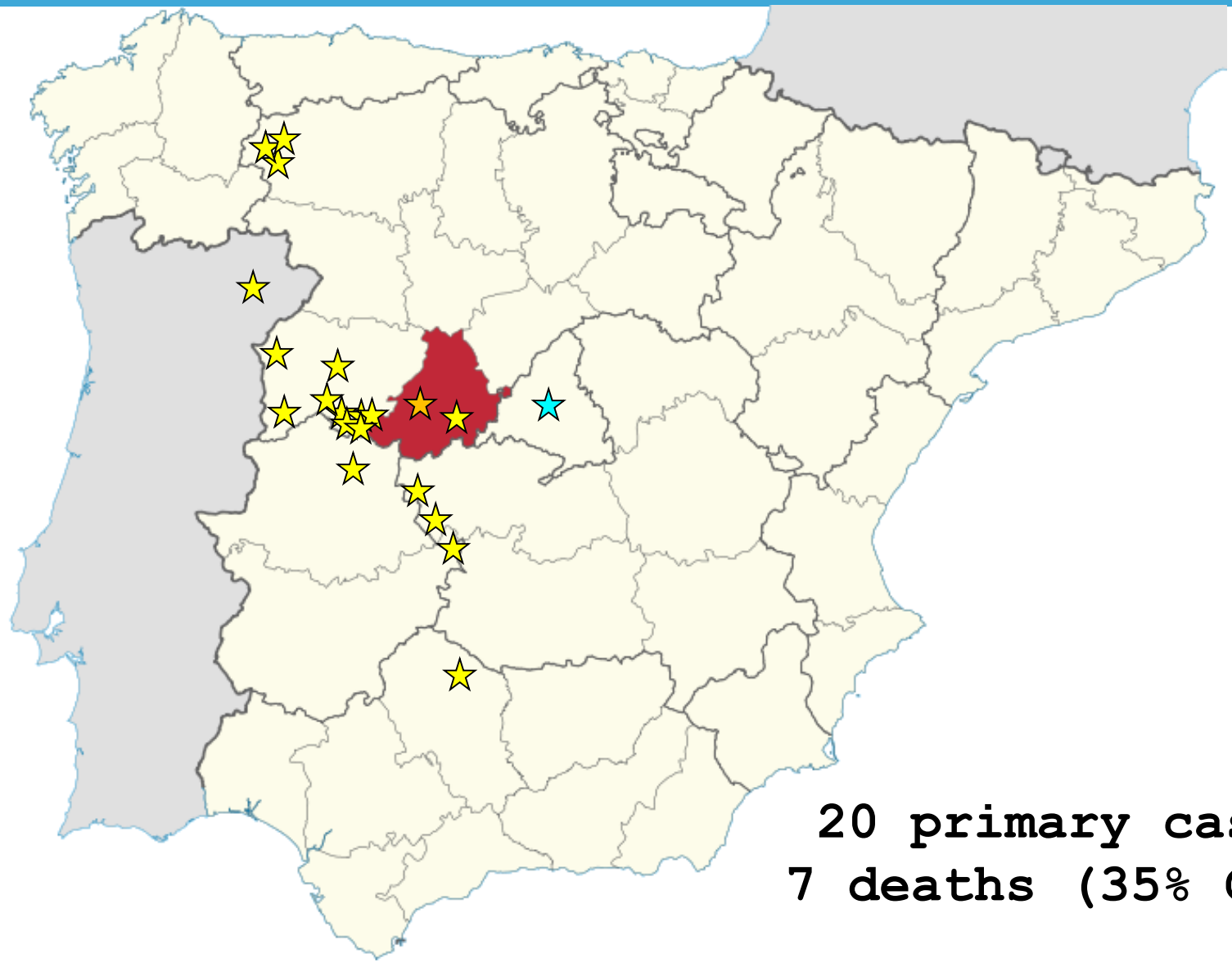
Antiviral Research 144 (2017) 93–119

Aysen Gargili [a, b, c], Agustin Estrada-Peña [d], Jessica R. Spengler [e], Alexander Lukashev [f, g], Patricia A. Nuttall [h], Dennis A. Bente [a, b, *]



CCHF cases in Iberia (2013-2025)

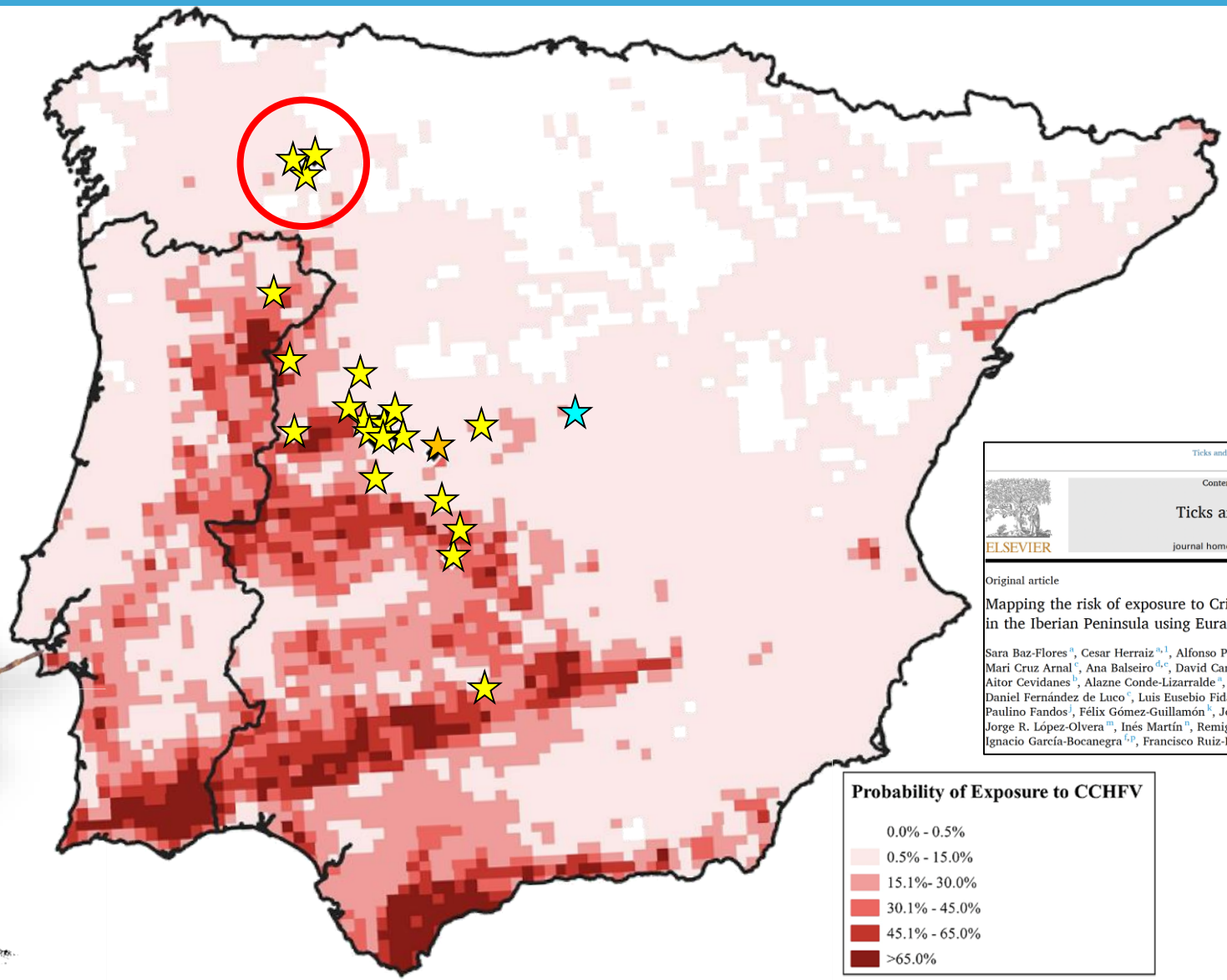
2013: *Retrospective* (2020)
2016: Tick bite - Hike (*Dead*)
Nosocomial
2018: Tick bite - Hunt (*Dead*)
Tick bite - Farm
2020: Tick bite
Tick bite - Farm
Tick bite (*Dead*)
2021: Tick bite - Farm
Tick bite - Hike
2022: Tick bite - Hike
Unknown – Forestry (*Dead*)
2023: Tick bite
2024: Tick bite – *Dead*
Tick bite – *Dead*
Tick bite
Unknown
Tick bite – *Dead*
2025: Tick bite
Tick bite
Tick bite

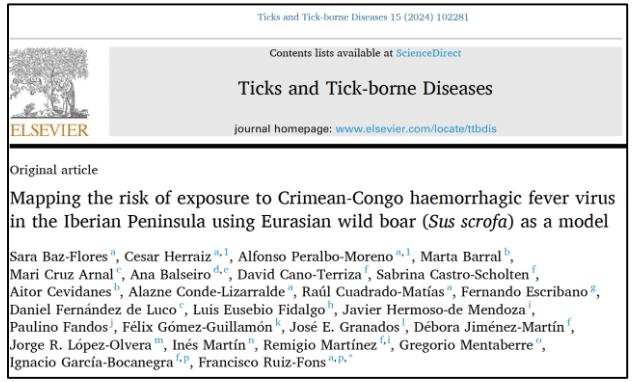


20 primary cases
7 deaths (35% CFR

CCHF cases in Iberia (2013-2025) *vs.* predicted risk

2013: *Retrospective* (2020)
2016: Tick bite - Hike (*Dead*)
Nosocomial
2018: Tick bite - Hunt (*Dead*)
Tick bite - Farm
2020: Tick bite
Tick bite - Farm
Tick bite (*Dead*)
2021: Tick bite - Farm
Tick bite - Hike
2022: Tick bite - Hike
Unknown – Forestry (*Dead*)
2023: Tick bite
2024: Tick bite – *Dead*
Tick bite – *Dead*
Tick bite
Unknown
Tick bite – *Dead*
2025: Tick bite
Tick bite
Tick bite




Ticks and Tick-borne Diseases 15 (2024) 102281

Contents lists available at ScienceDirect

Ticks and Tick-borne Diseases

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

ELSEVIER

Original article

Mapping the risk of exposure to Crimean-Congo haemorrhagic fever virus in the Iberian Peninsula using Eurasian wild boar (*Sus scrofa*) as a model

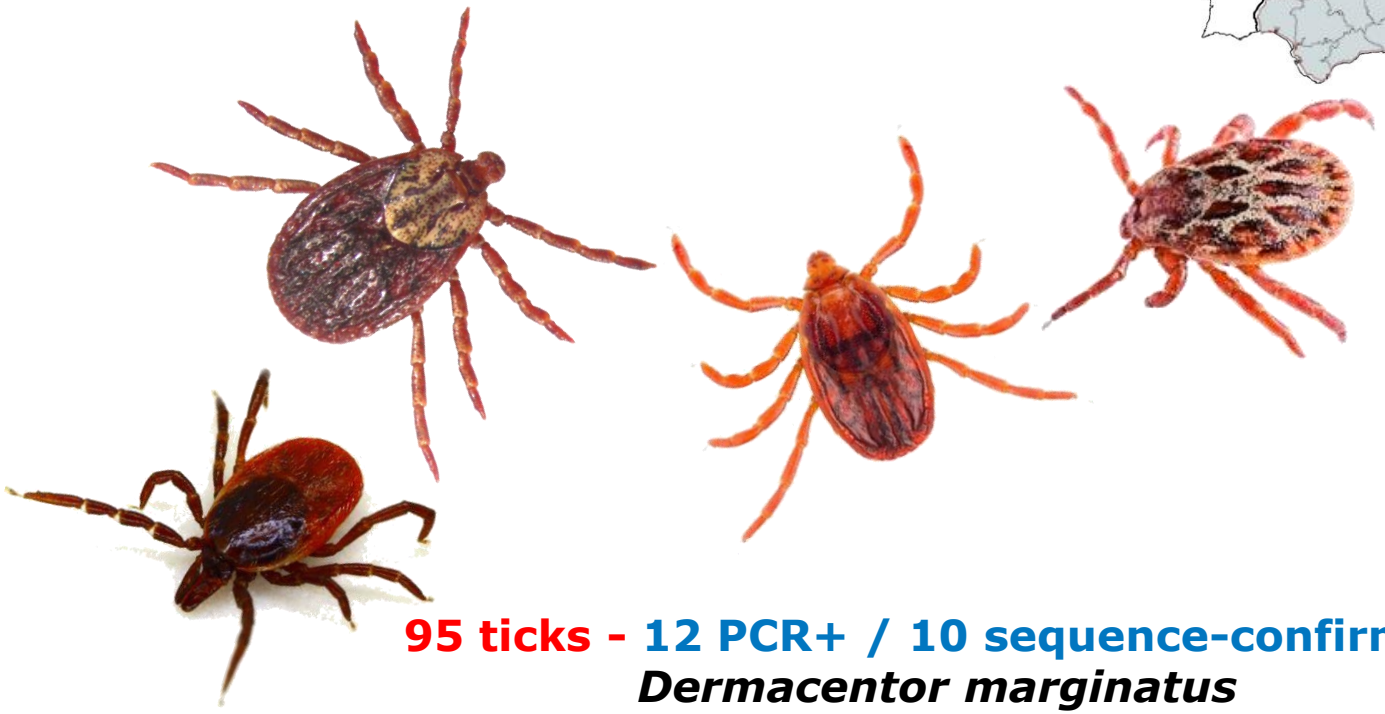
Sara Baz-Flores [a], Cesar Herraiz [a,1], Alfonso Peralbo-Moreno [a,1], Marta Barral [b], Mari Cruz Arnal [c], Ana Balseiro [d,c], David Cano-Terriza [f], Sabrina Castro-Scholten [f], Aitor Cevidanes [b], Alazne Conde-Lizarralde [a], Raúl Cuadrado-Matías [a], Fernando Escribano [g], Daniel Fernández de Luco [c], Luis Eusebio Fidalgo [h], Javier Hermoso-de Mendoza [i], Paulino Fandos [j], Félix Gómez-Guillamón [k], José E. Granados [i], Débora Jiménez-Martín [f], Jorge R. López-Olvera [m], Inés Martín [n], Remigio Martínez [f,i], Gregorio Mentaberre [o], Ignacio García-Bocanegra [f,p], Francisco Ruiz-Fons [a,p,*]

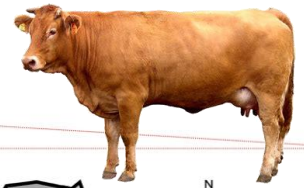
New CCHFV transmission scenarios?

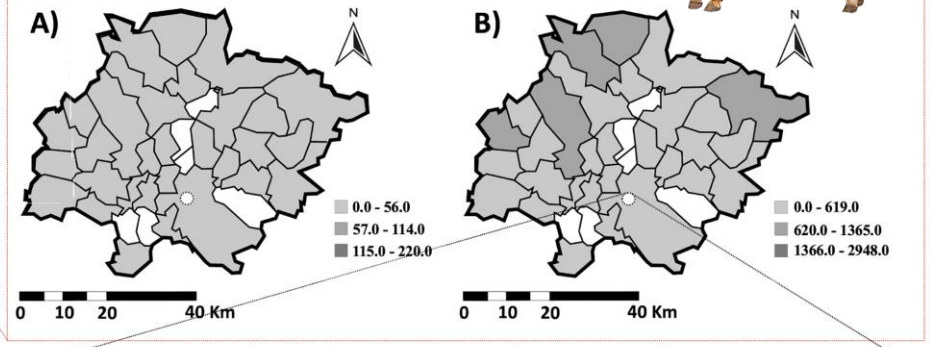
Crimean–Congo haemorrhagic fever virus in questing non-*Hyalomma* spp. ticks in Northwest Spain, 2021

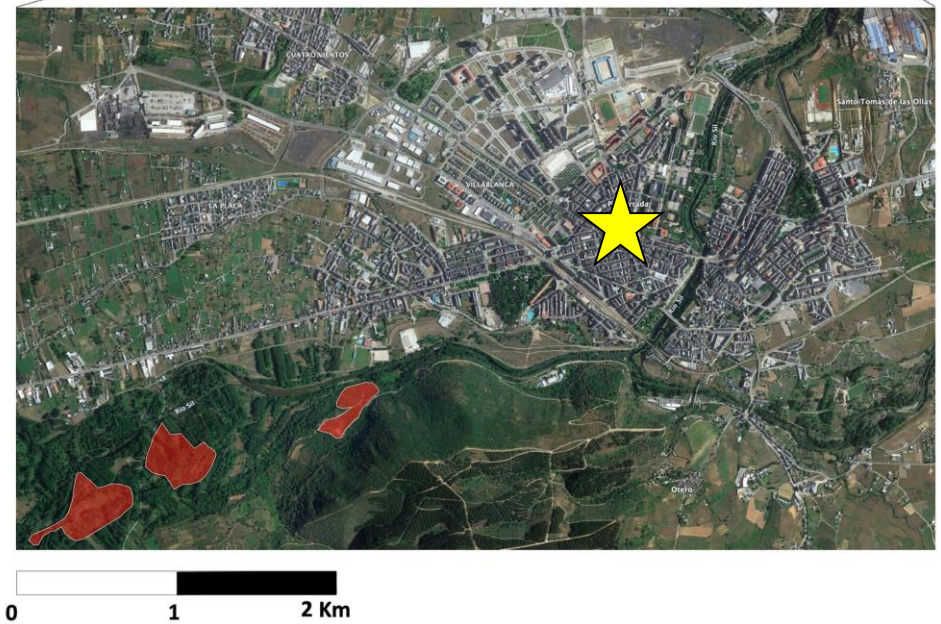
Zoonoses Public Health. 2024;71:578–583.

Raúl Cuadrado-Matías[1] | Alberto Moraga-Fernández[1] | Alfonso Peralbo-Moreno[1]
Ana Isabel Negredo[2,3] | María Paz Sánchez-Seco[2,3] | Francisco Ruiz-Fons[1,3]









95 ticks - 12 PCR+ / 10 sequence-confirmed

Dermacentor marginatus

Ixodes ricinus

Rhipicephalus sanguineus group

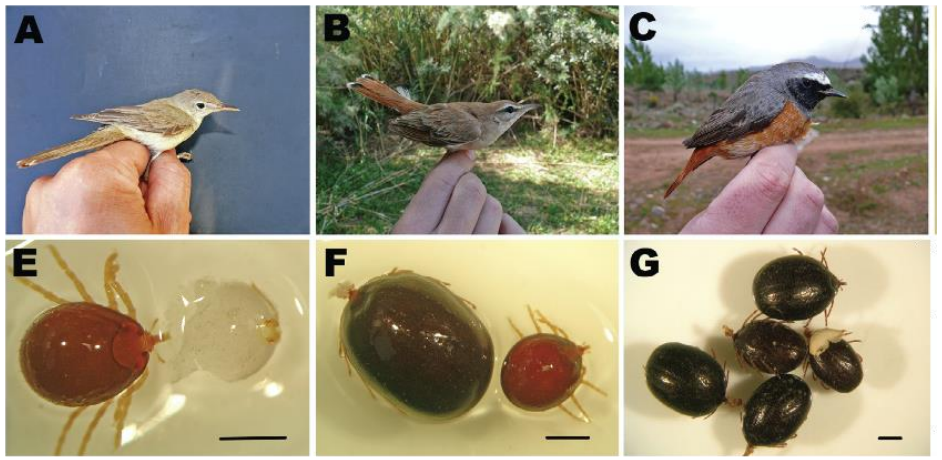
Rhipicephalus bursa

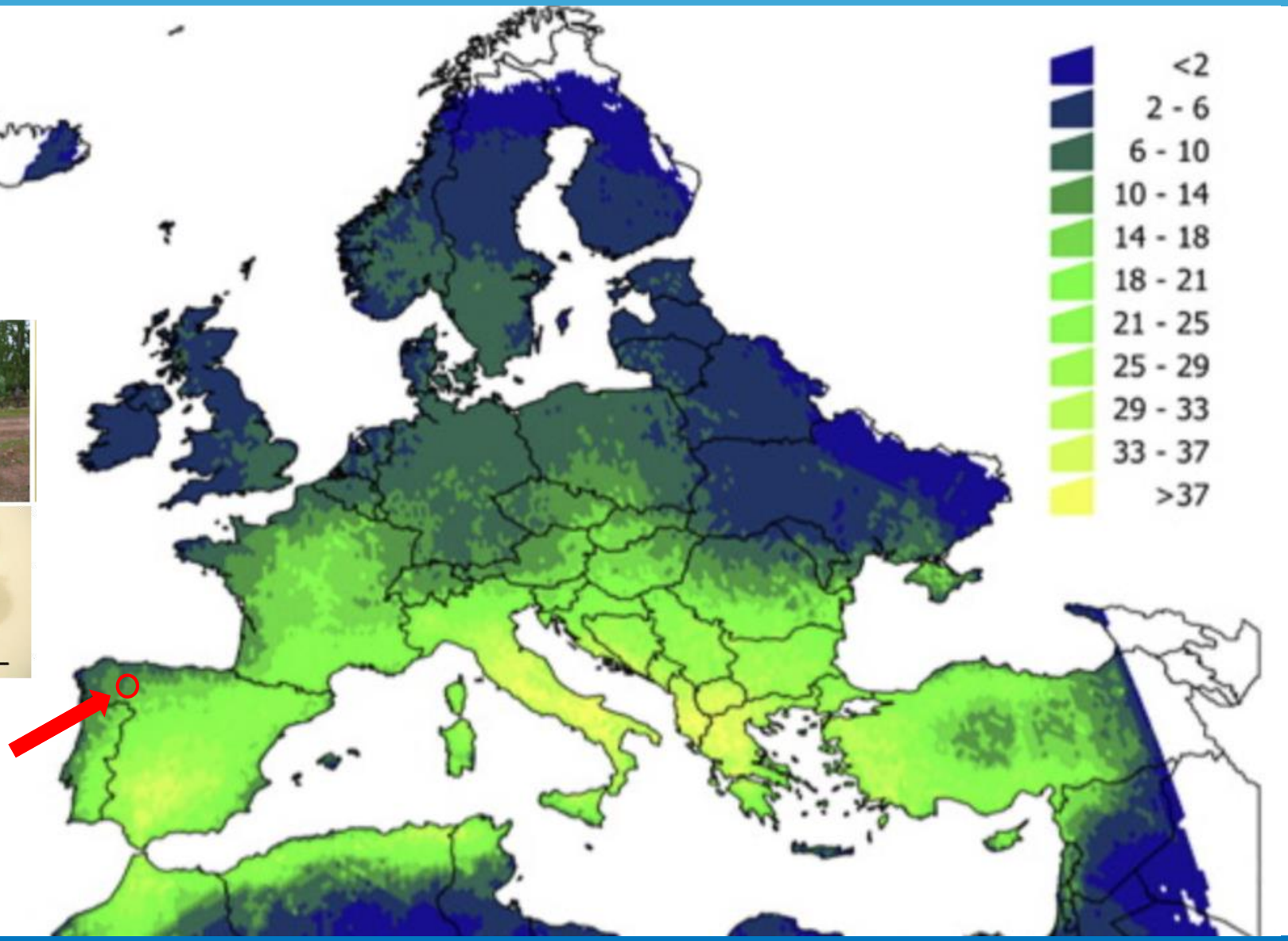
Or just sporadic CCHFV-infected *Hyalomma* tick incursions?

International Journal for Parasitology
Volume 51, Issue 1, January 2021, Pages 1-11

Modelling the potential spread of *Hyalomma marginatum* ticks in Europe by migratory birds

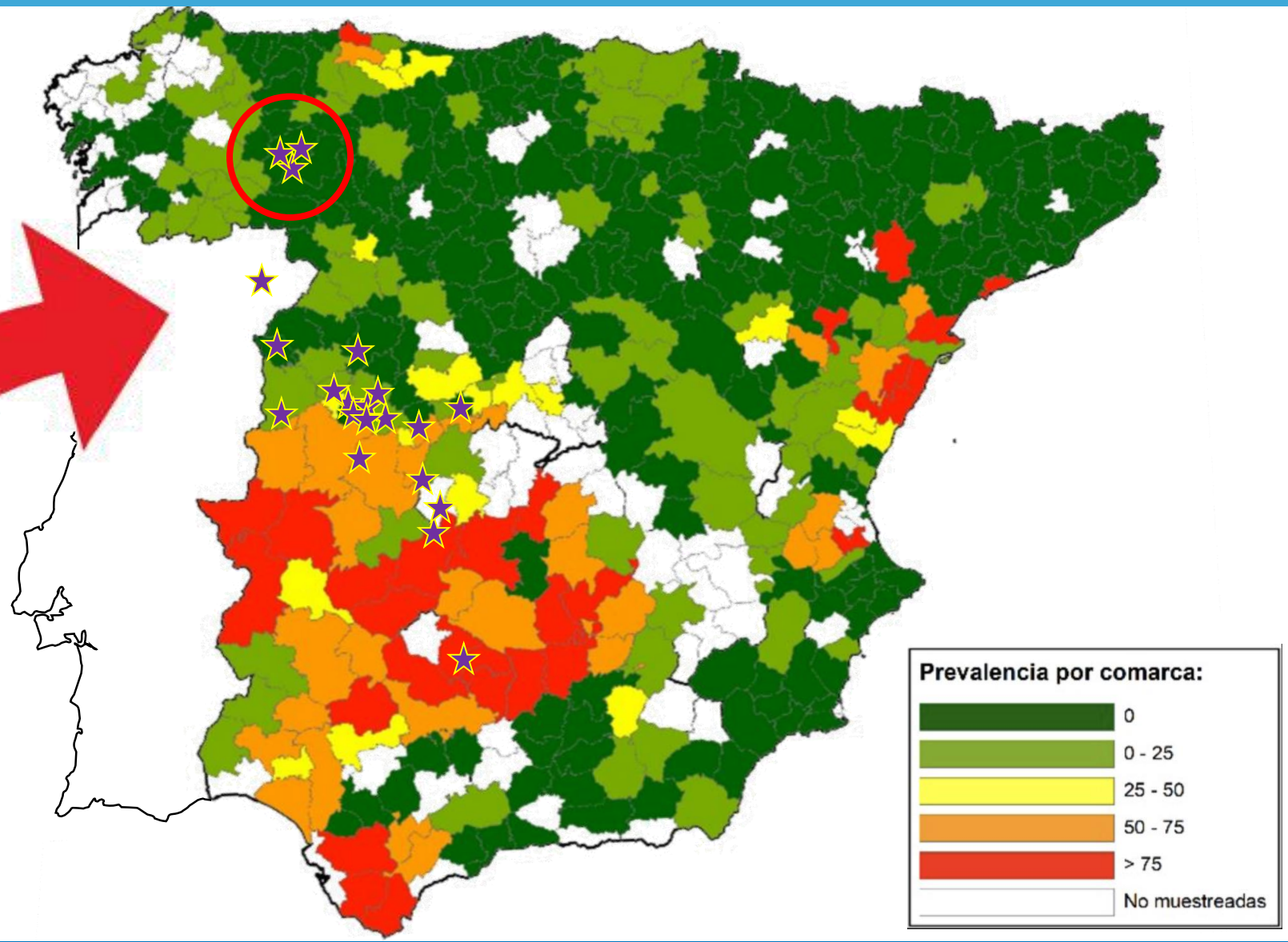
Agustín Estrada-Peña [a b], Gianluca D'Amico [c], Natalia Fernández-Ruiz [a]





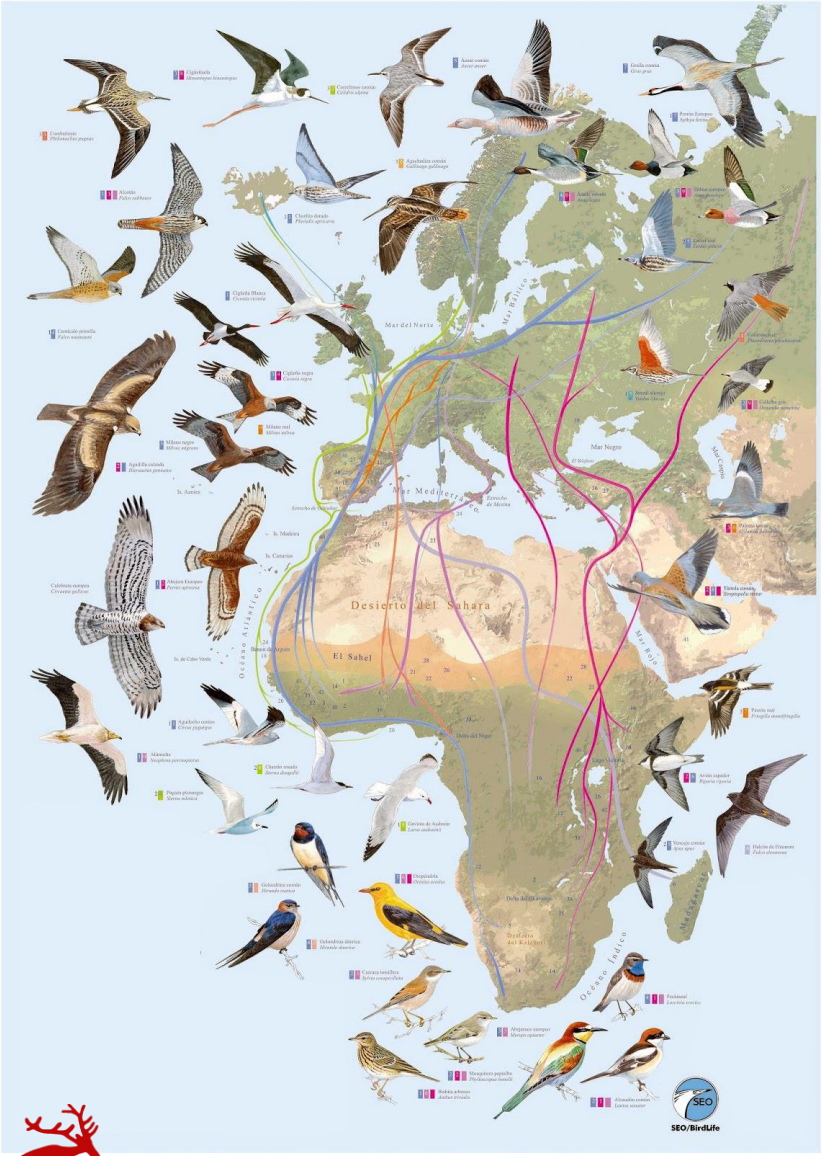
CCHF cases in Iberia (2013-2025) *vs.* predicted risk

GOBIERNO DE ESPAÑA
MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN



irec
CSIC
UCLM
Universidad de Castilla-La Mancha
Castilla-La Mancha

How many *H. marginatum* arrive on migratory birds annually?



OIKOS
ADVANCING ECOLOGY

The natural link between Europe and Africa – 2.1 billion birds on migration

Steffen Hahn, Silke Bauer, Felix Liechti

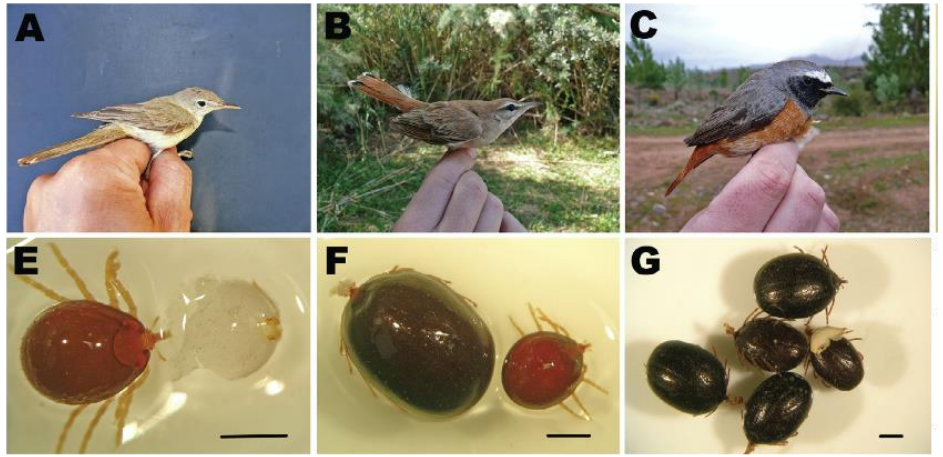
First published: 31 March 2009 | https://doi.org/10.1111/j.1600-0706.2008.17309.x |

2,100,000,000 passerines / near-passer

Crimean-Congo Hemorrhagic Fever Virus in Ticks from Migratory Birds, Morocco[1]

Ana M. Palomar, Aránzazu Portillo, Paula Santibáñez, David Mazuelas, Juan Arizaga, Ariñe Crespo, Óscar Gutiérrez, Juan Francisco Cuadrado, and José A. Oteo

Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 19, No. 2, February 2013



3.8% with *Hyalomma* ticks

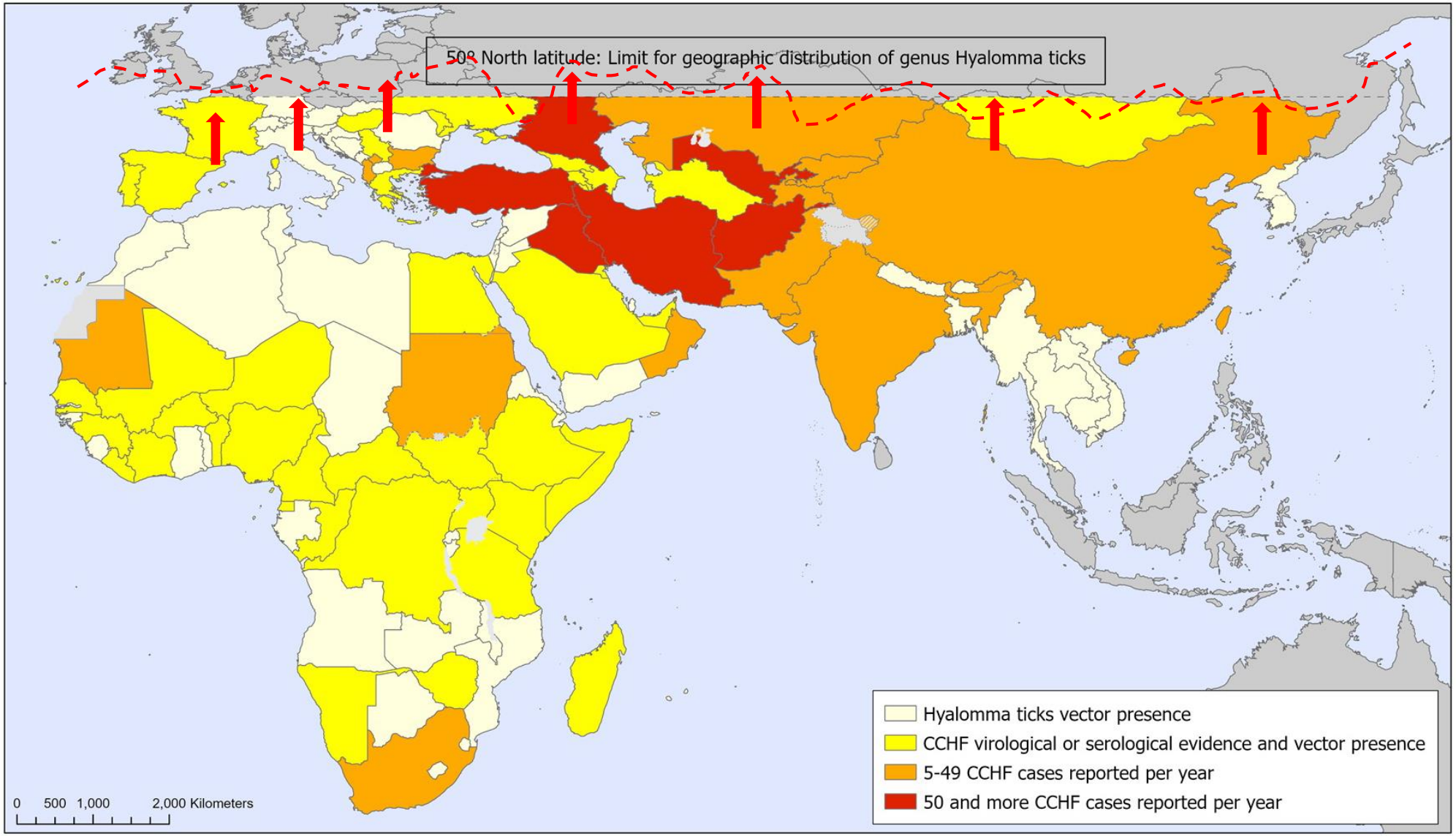
2.5 ticks per bird

79,800,000 birds with *H. marginatum* ticks

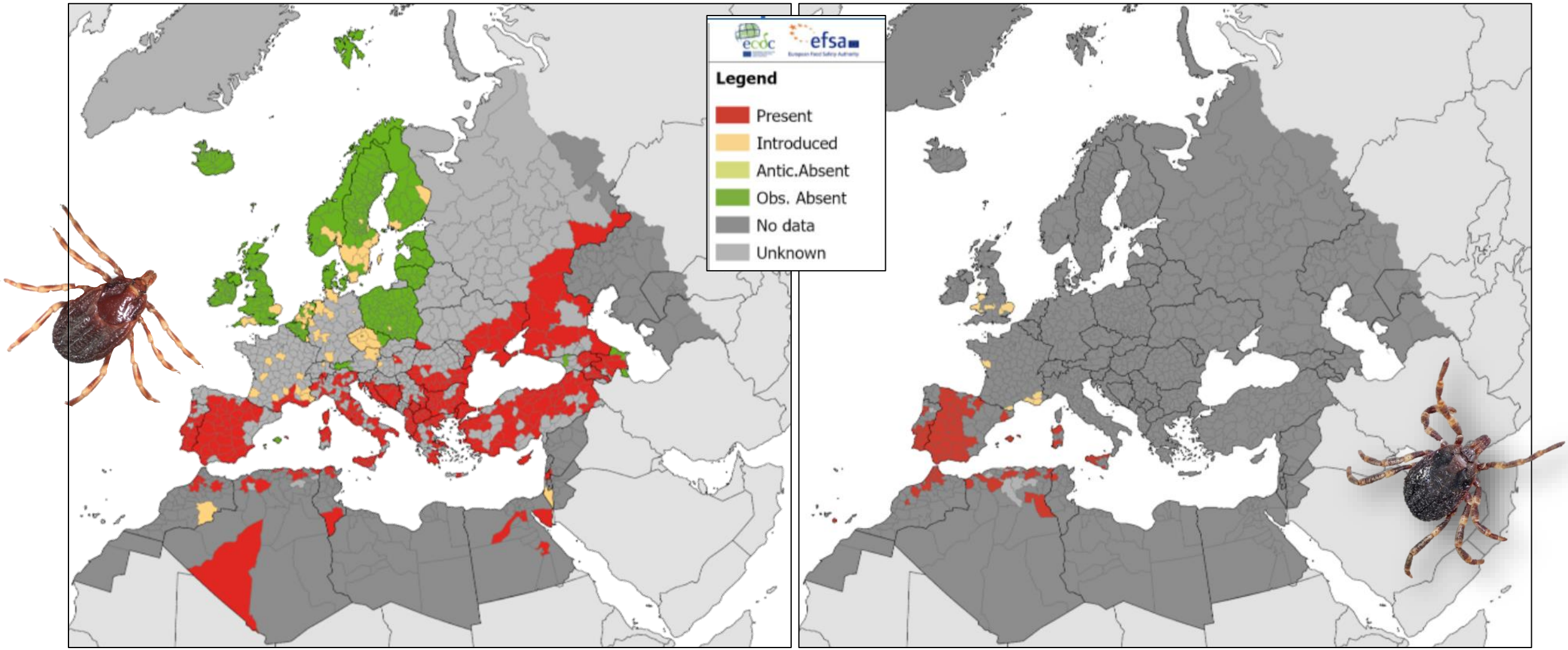
199,500,000 *H. marginatum* ticks/year

2 million CCHFV-infected *Hyalomma* tick

Northern limits for CCHFV expansion?



Northern limits for CCHFV expansion?

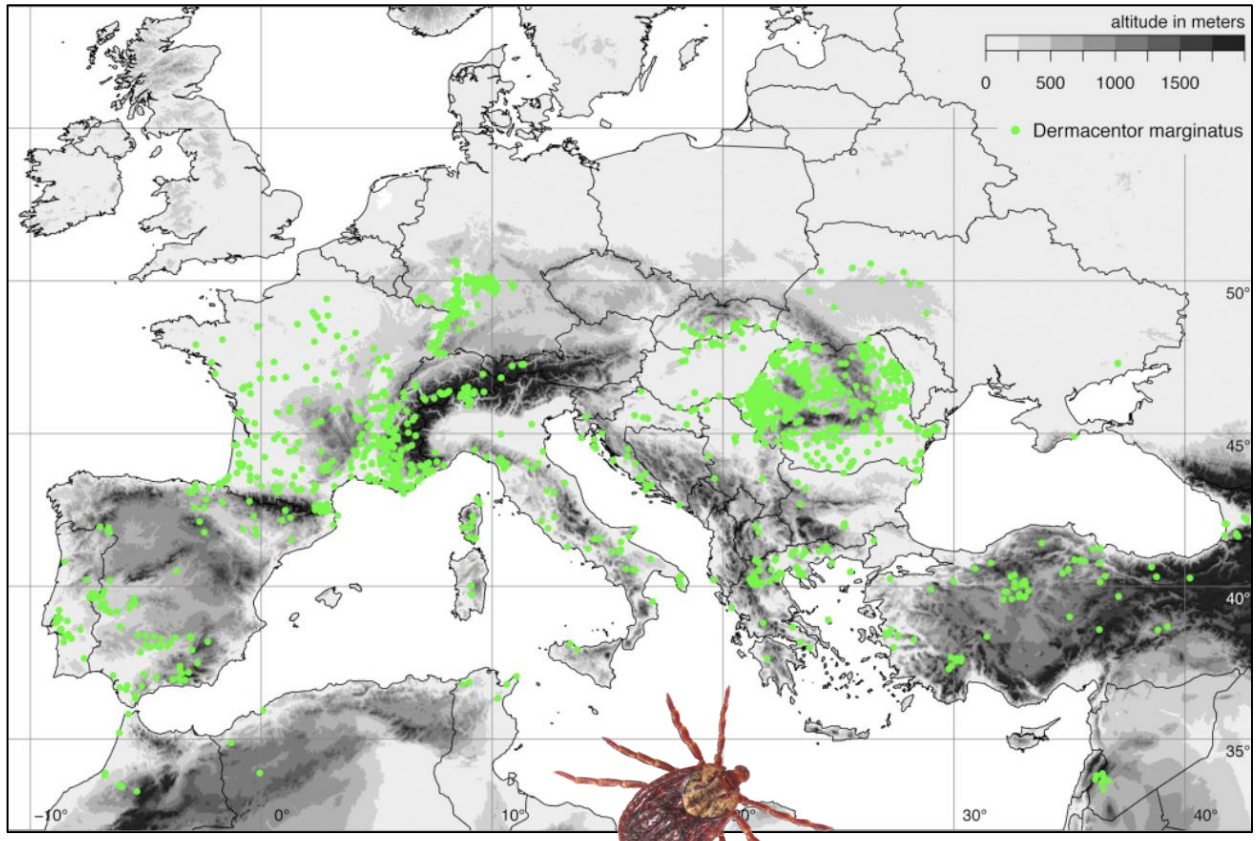


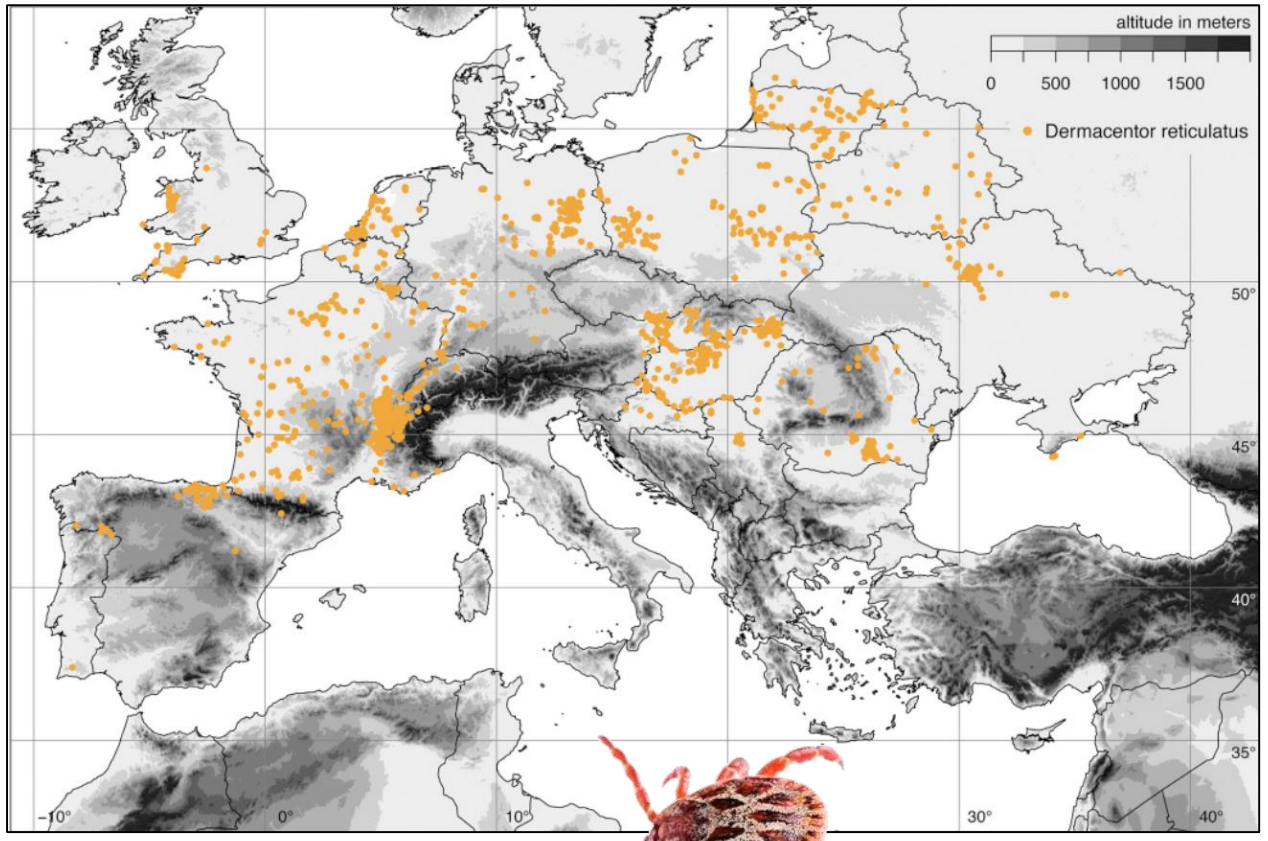
Northern limits for CCHFV expansion - new scenarios???

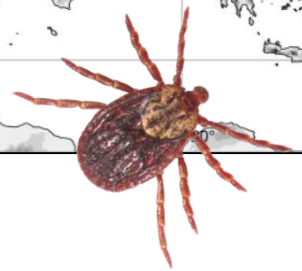
Geographical distribution of *Dermacentor marginatus* and *Dermacentor reticulatus* in Europe

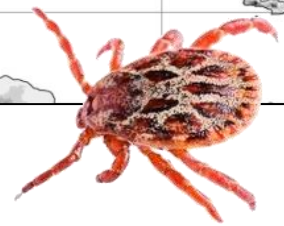
Ticks and Tick-borne Diseases 7 (2016) 224–233

Franz Rubel[a,*], Katharina Brugger[a], Martin Pfeffer[b], Lidia Chitimia-Dobler[c], Yuliya M. Didyk[d], Sandra Leverenz[e], Hans Dautel[e], Olaf Kahl[e]







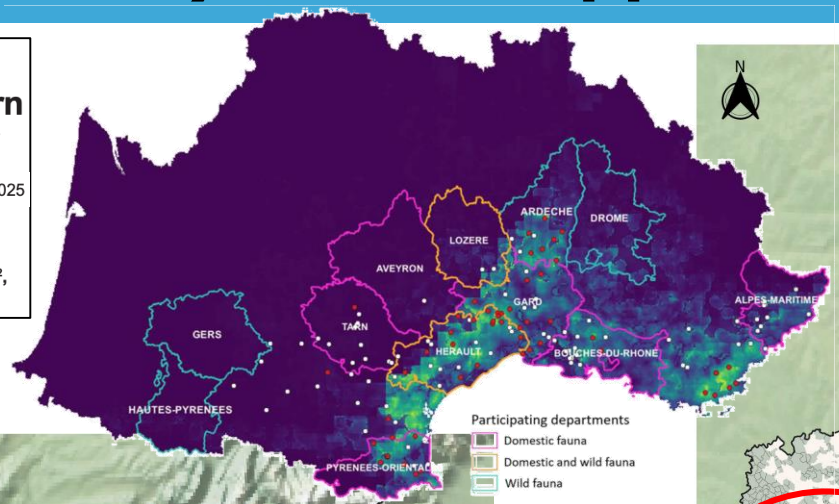


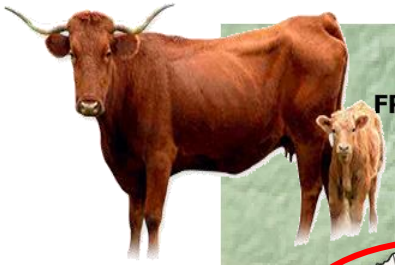
CCHFV evidence outside *Hyalomma* spp. distribution range

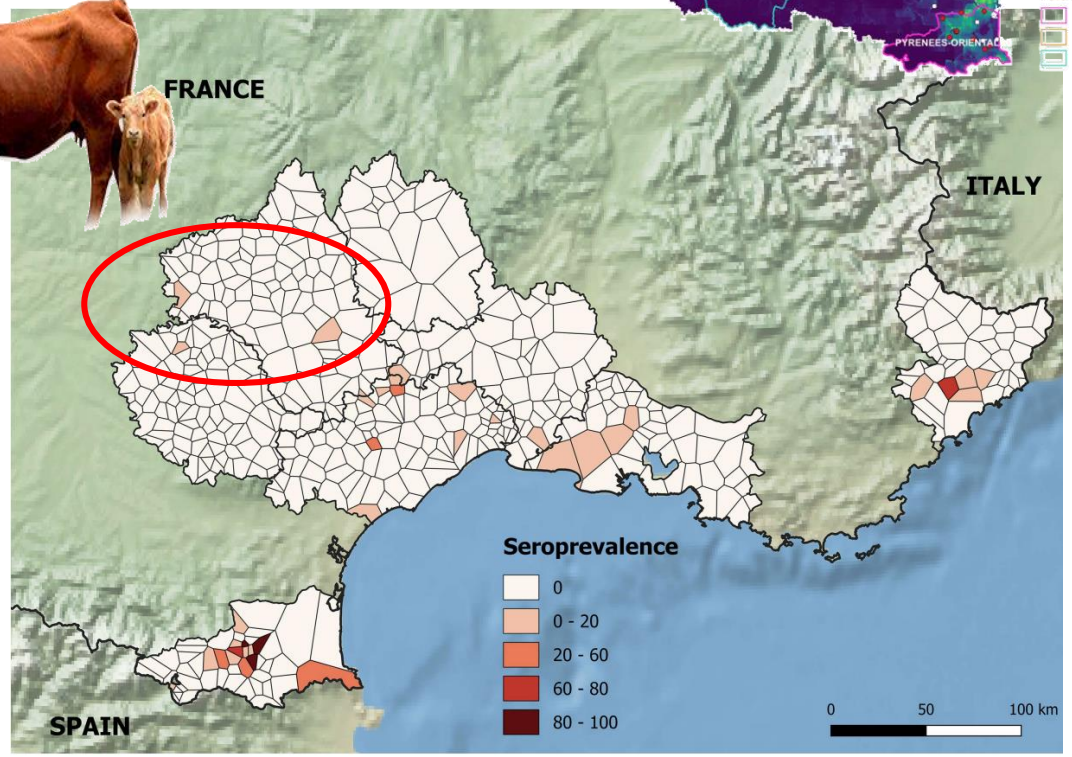
First detection of Crimean Congo Hemorrhagic Fever antibodies in cattle and wildlife of southern continental France: Investigation of explanatory factors

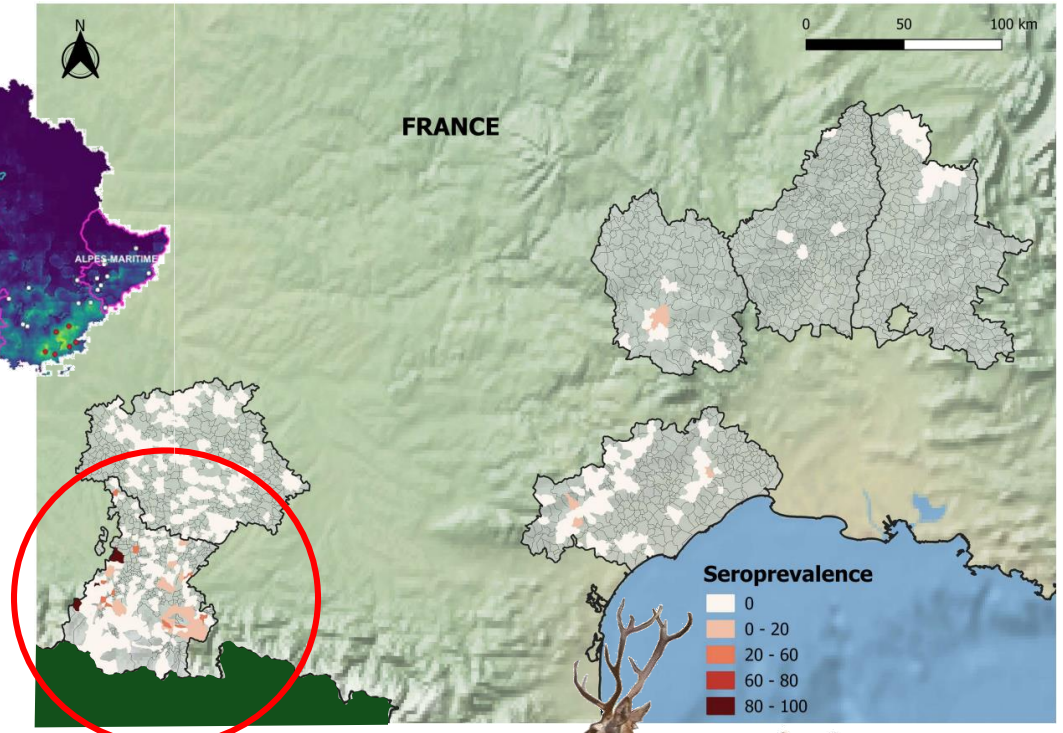
PLOS One | https://doi.org/10.1371/journal.pone.0331875 September 24, 2025

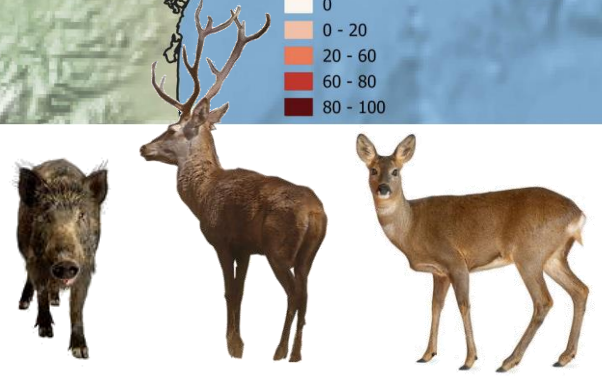
Célia Bernard[1,2,3*], Andrea Apolloni[1,2], Vladimir Grosbois[1,2], Armelle Peyraud[1,2], Phonsiri Saengram[1,2], Ferran Jori[1,2], Eva Faure[4], Nicolas Keck[5], Raphaëlle Pin[6], Olivier Ferraris[7], Loic Comtet[8], Benoit Combes[3], Matthieu Bastien[3], Valentin Chauvin[1,2], Laure Guerrini[1,2], Philippe Holzmuller[1,2], Laurence Vial[1,2]











Ecological links of *H. lusitanicum* & CCHFV dynamics

Environmental factors driving fine-scale ixodid tick abundance patterns

Alfonso Peralbo-Moreno [a], Sara Baz-Flores [a,1], Raúl Cuadrado-Matías [a,1], Patricia Barroso [a], Roxana Triguero-Ocaña [b], Saúl Jiménez-Ruiz [a,c], Cesar Herraiz [a], Carmen Ruiz-Rodríguez [a], Pelayo Acevedo [a], Francisco Ruiz-Fons [a,*]

Science of the Total Environment 853 (2022) 158633

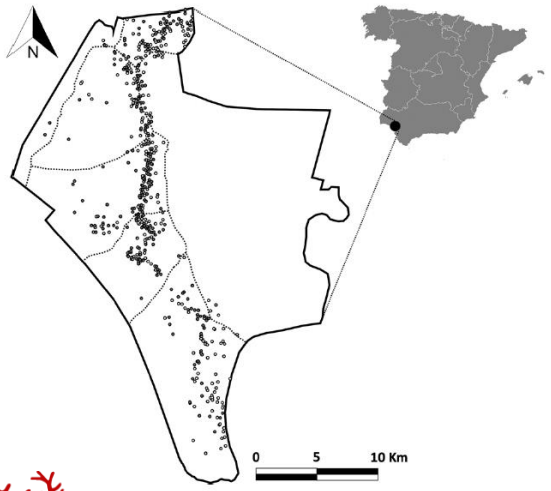
DOI: 10.1111/tbed.14720

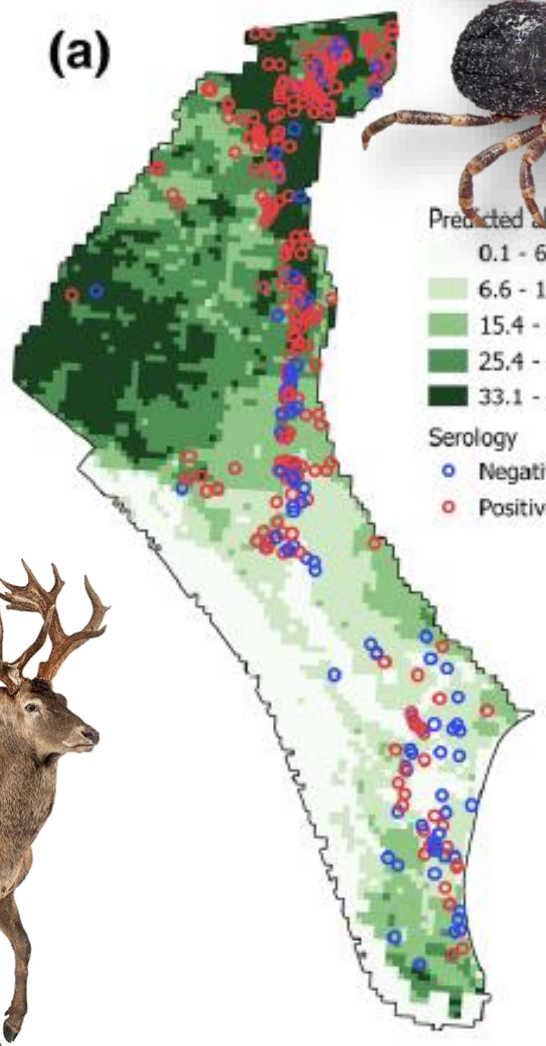
Transboundary and Emerging Diseases WILEY

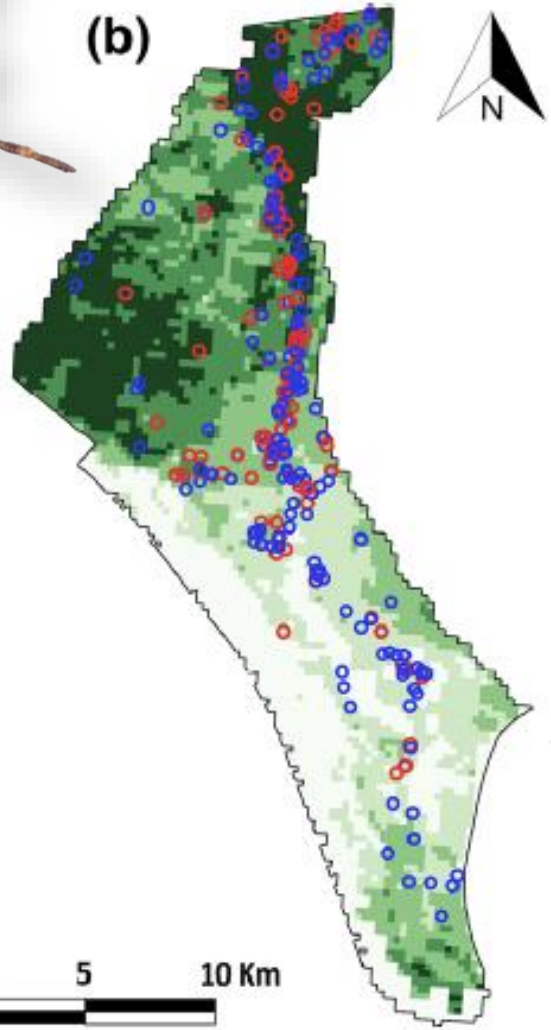
ORIGINAL ARTICLE

Determinants of Crimean–Congo haemorrhagic fever virus exposure dynamics in Mediterranean environments

Raúl Cuadrado-Matías[1] | Sara Baz-Flores[1] | Alfonso Peralbo-Moreno[1] | Gloria Herrero-García[1,2] | María A. Risalde[3,4] | Patricia Barroso[1] | Saúl Jiménez-Ruiz[1,5] | Carmen Ruiz-Rodriguez[1] | Francisco Ruiz-Fons[1]







irec

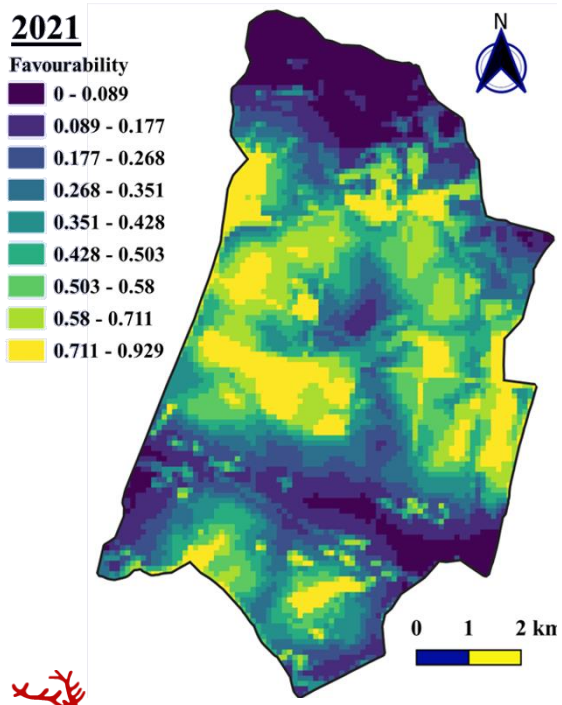
CSIC UCLM Universidad de Castilla-La Mancha Castilla-La Mancha

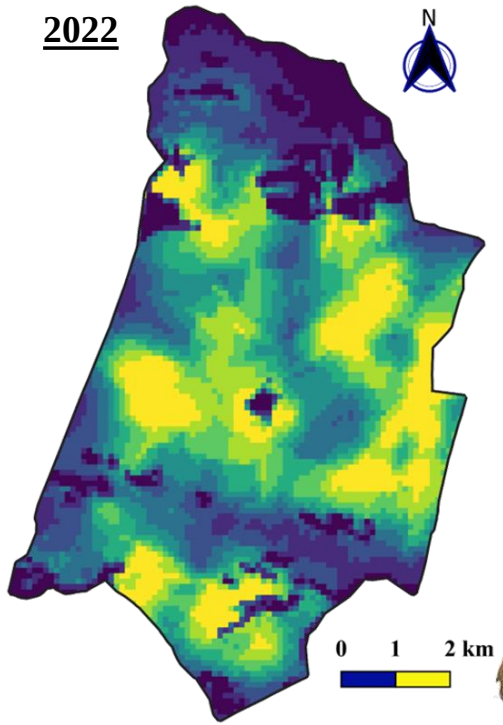
Ecological links of *H. lusitanicum* & CCHFV dynamics

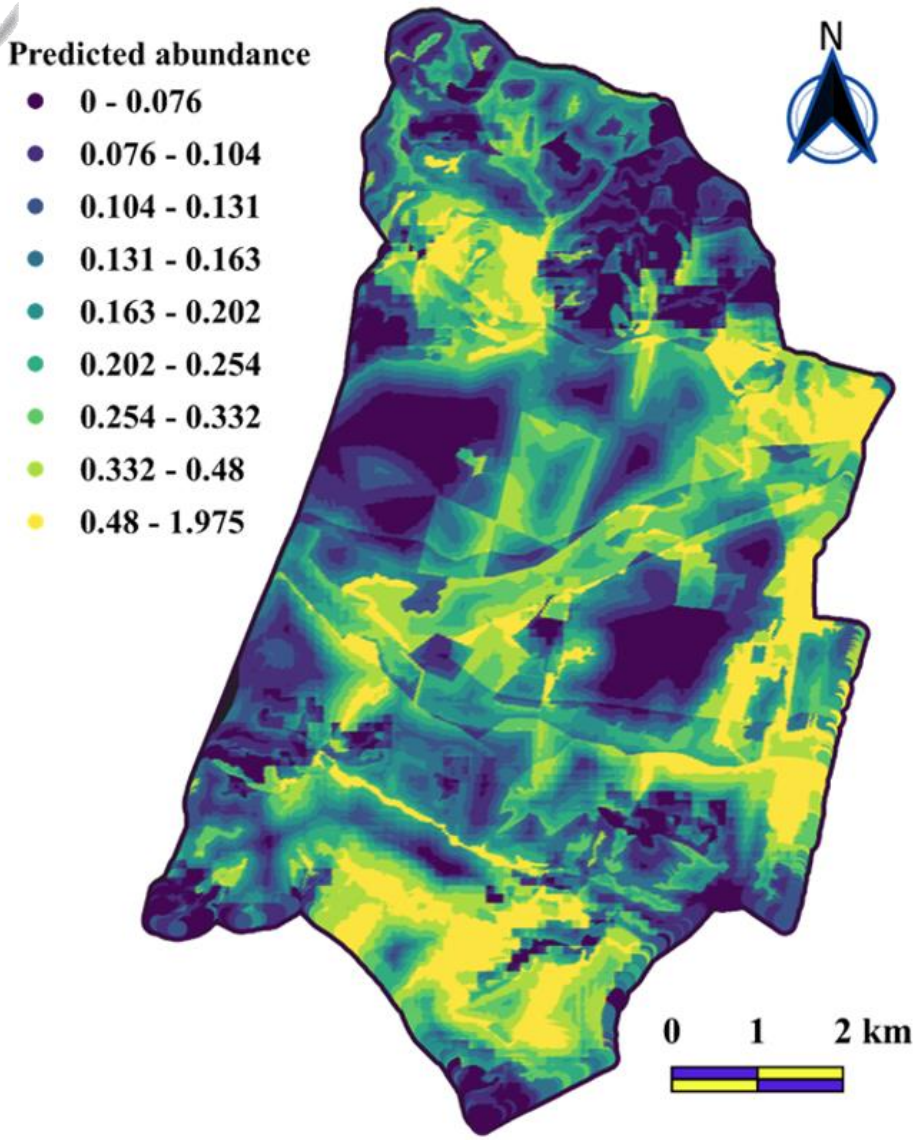
International Journal for Parasitology
Volume 55, Issues 8–9, July 2025, Pages 435-445

Modelling the small spatial scale questing abundance of *Hyalomma lusitanicum* Koch, 1844 (Acari: Ixodidae), vector of Crimean-Congo haemorrhagic fever virus

Alfonso Peralbo-Moreno [a], Raúl Cuadrado-Matías [a], Sara Baz-Flores [a], Pelayo Acevedo [a], Francisco Ruiz-Fons [a b]







CCHFV transmission dynamics

Transboundary and Emerging Diseases

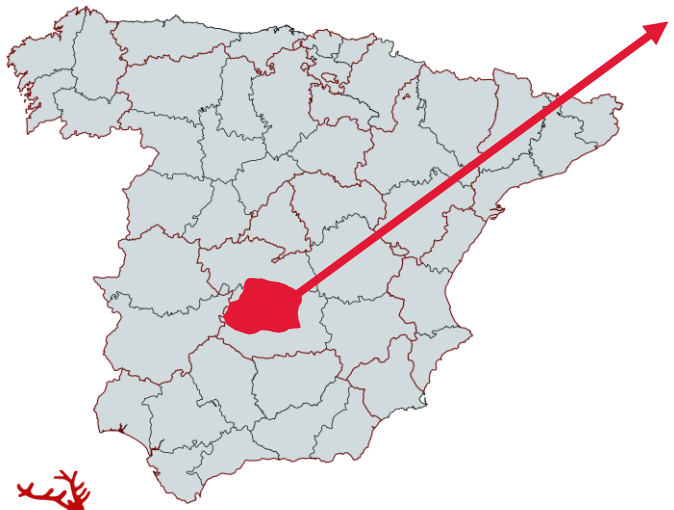
Research Article

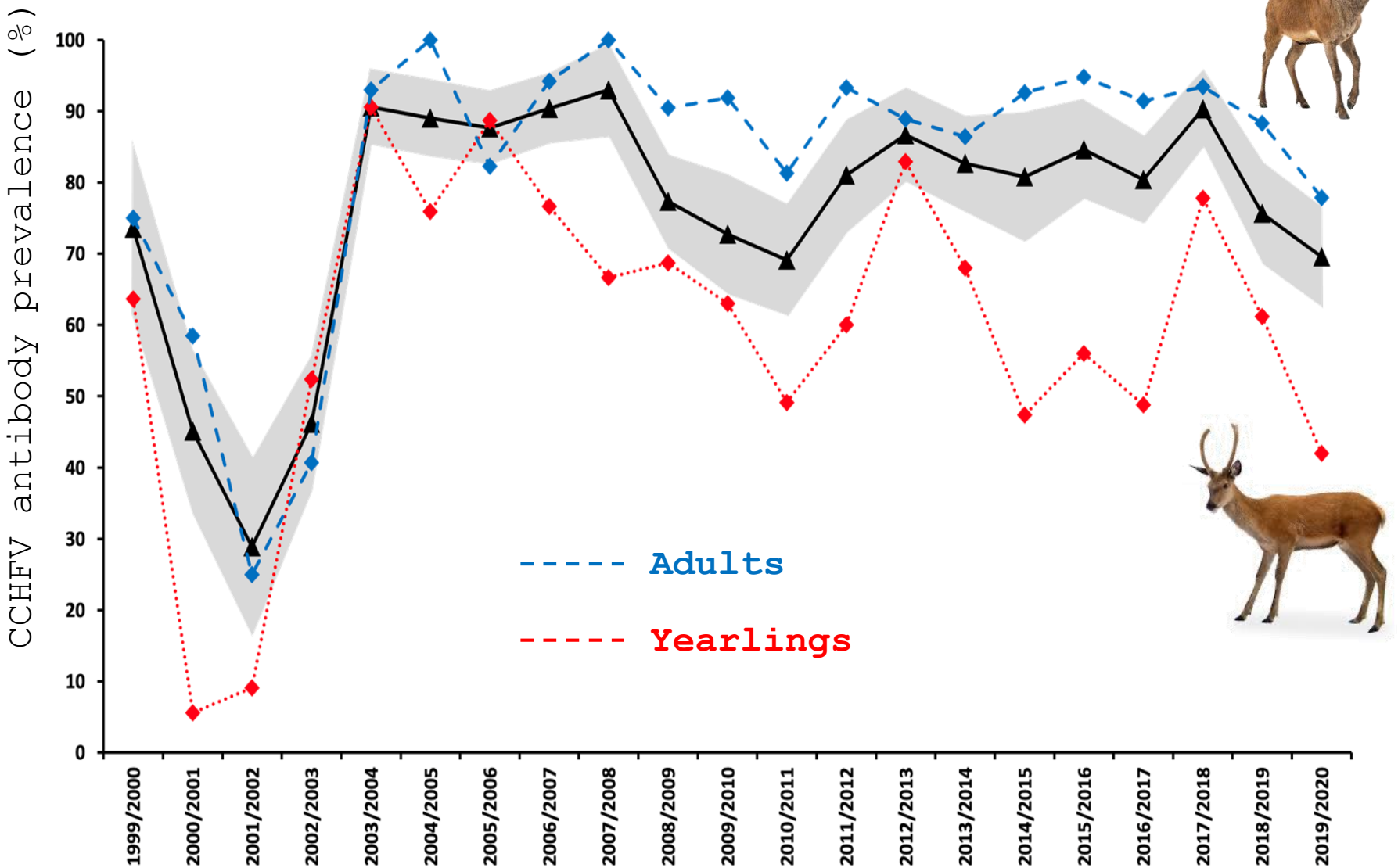
Environmental drivers of Crimean-Congo haemorrhagic fever virus spatiotemporal transmission dynamics

Submission ID a9476873-a959-4385-b41b-72808f957b59

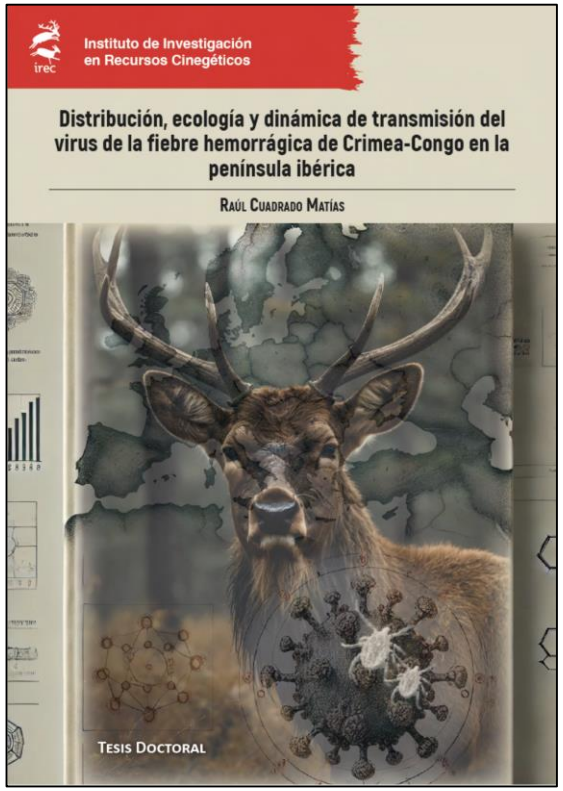
Submission Version Initial Submission

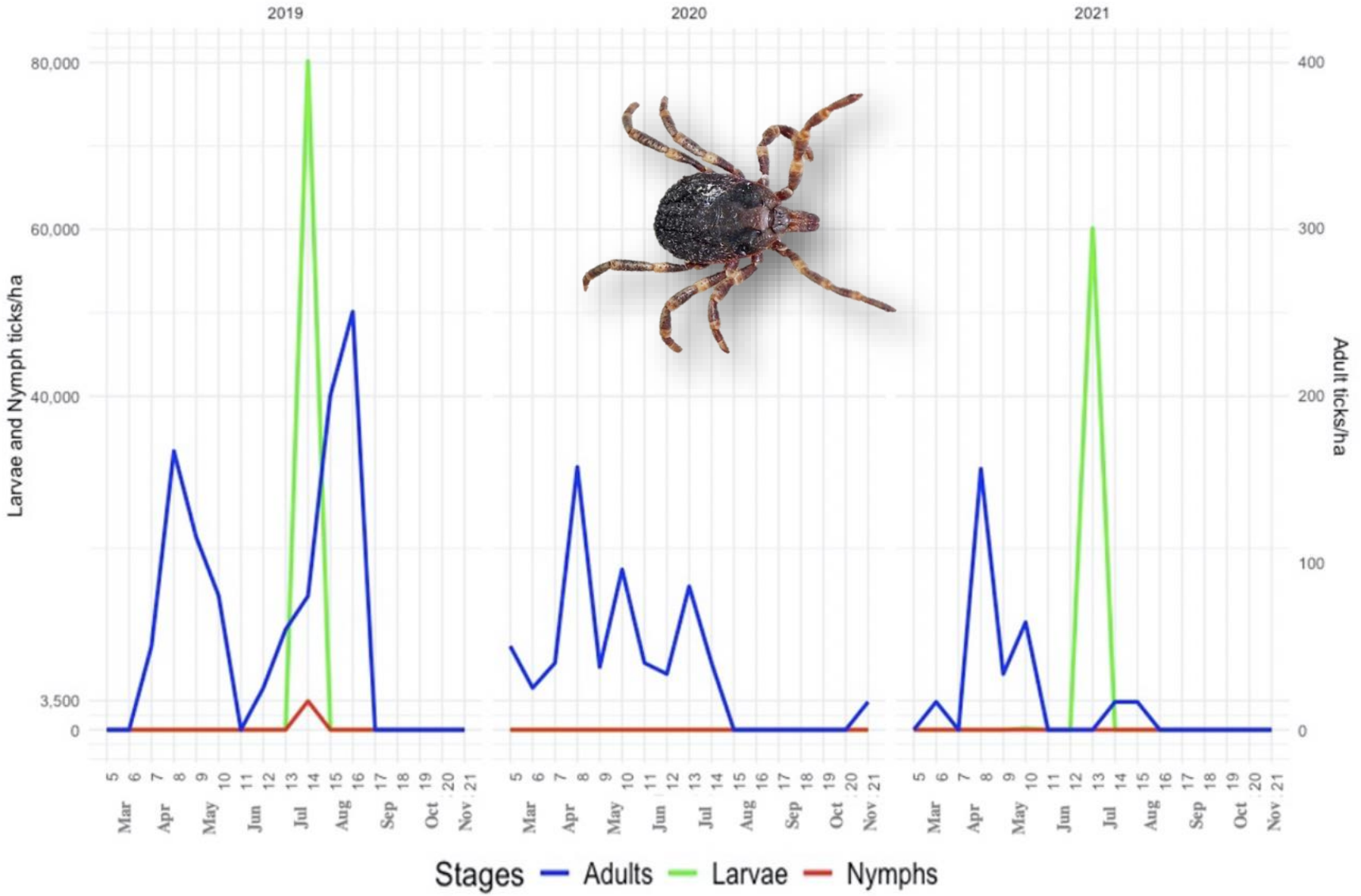
PDF Generation 09 Jan 2026 11:55:15 EST by Atypon ReX





CCHFV transmission dynamics





CCHFV transmission is linked to *Hyalomma lusitanicum*

Animal Exposure Model for Mapping Crimean-Congo Hemorrhagic Fever Virus Emergence Risk

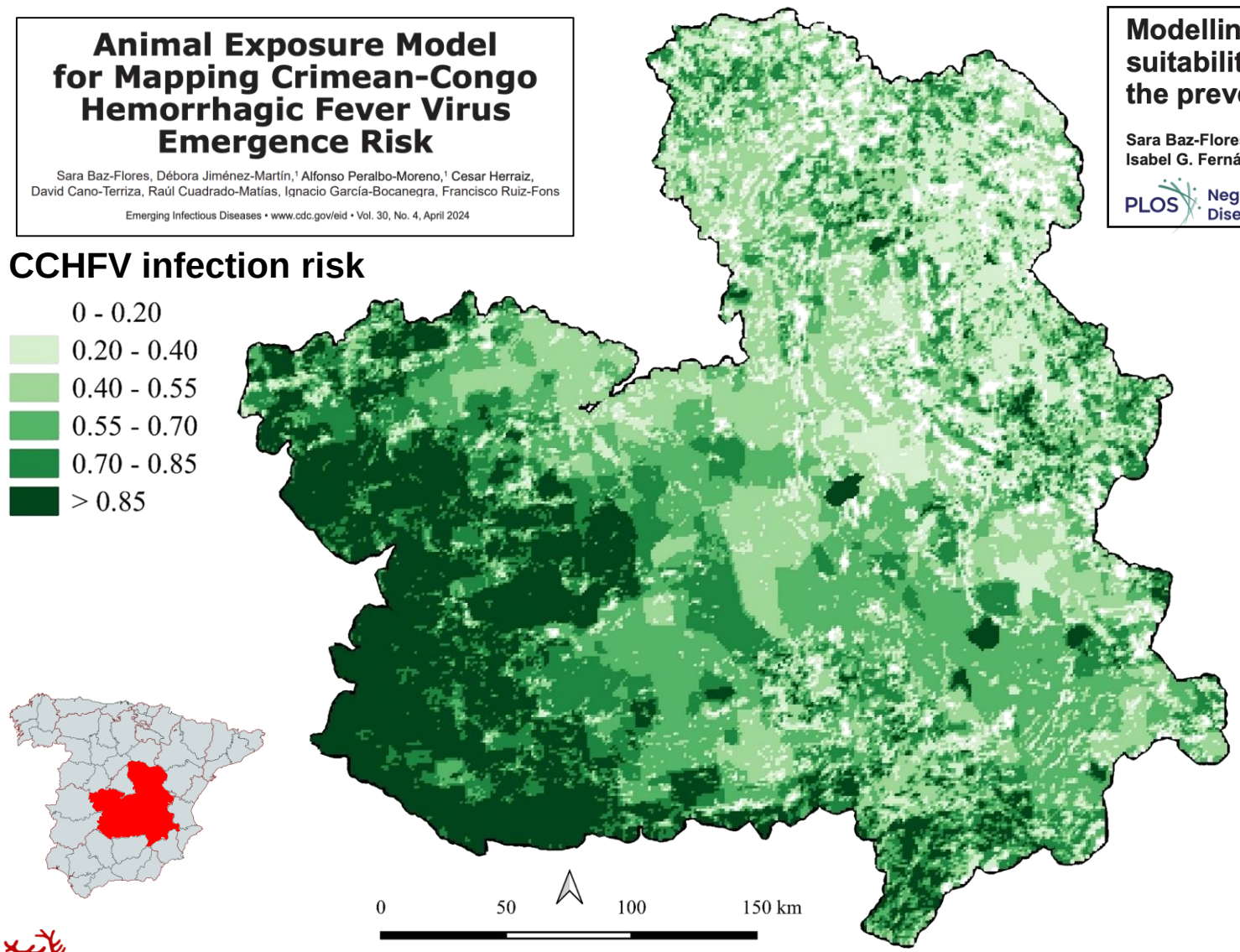
Sara Baz-Flores, Débora Jiménez-Martín,[1] Alfonso Peralbo-Moreno,[1] Cesar Herraiz, David Cano-Terriza, Raúl Cuadrado-Matías, Ignacio García-Bocanegra, Francisco Ruiz-Fons

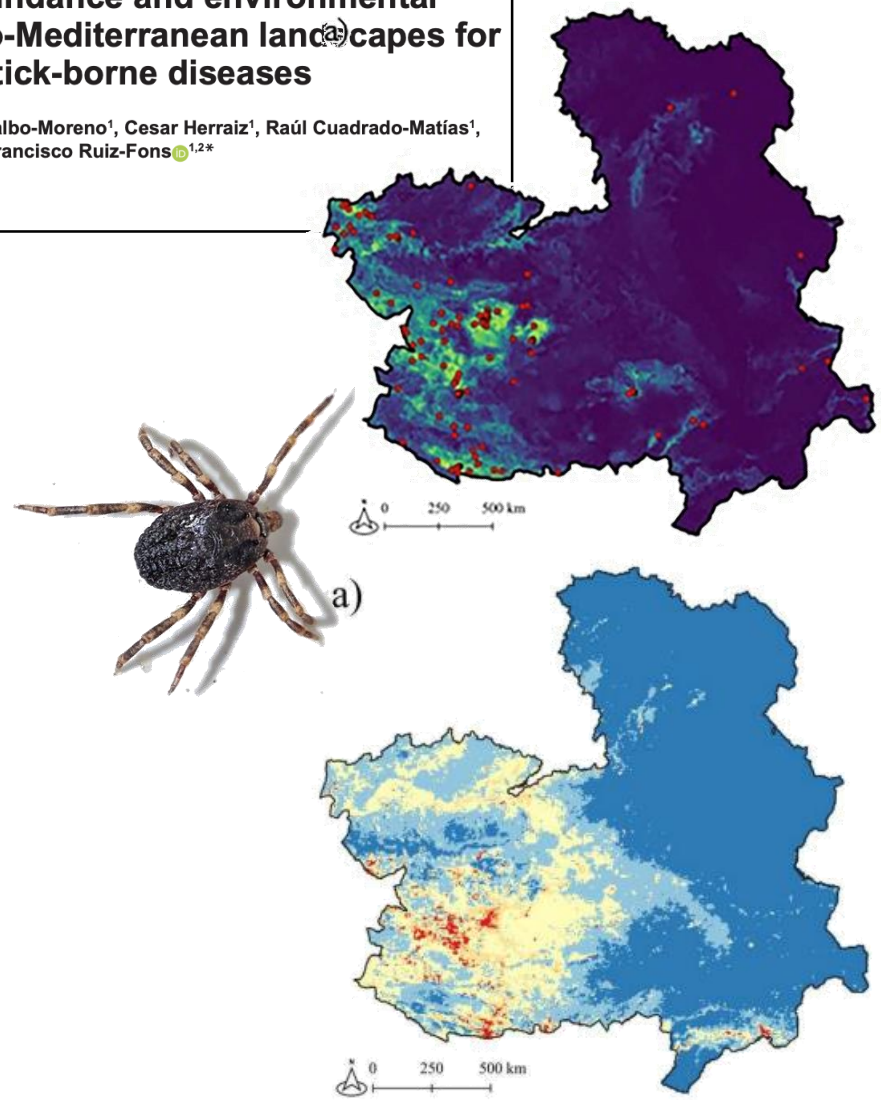
Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 30, No. 4, April 2024

Modelling tick abundance and environmental suitability in meso-Mediterranean landscapes for the prevention of tick-borne diseases

Sara Baz-Flores[1], Alfonso Peralbo-Moreno[1], Cesar Herraiz[1], Raúl Cuadrado-Matías[1], Isabel G. Fernández de Mera[1], Francisco Ruiz-Fons[1,2*]

PLOS Neglected Tropical Diseases





Is CCHFV transmission linked to *Hyalomma lusitanicum*??

DOI: 10.1111/tbed.14484

SHORT COMMUNICATION

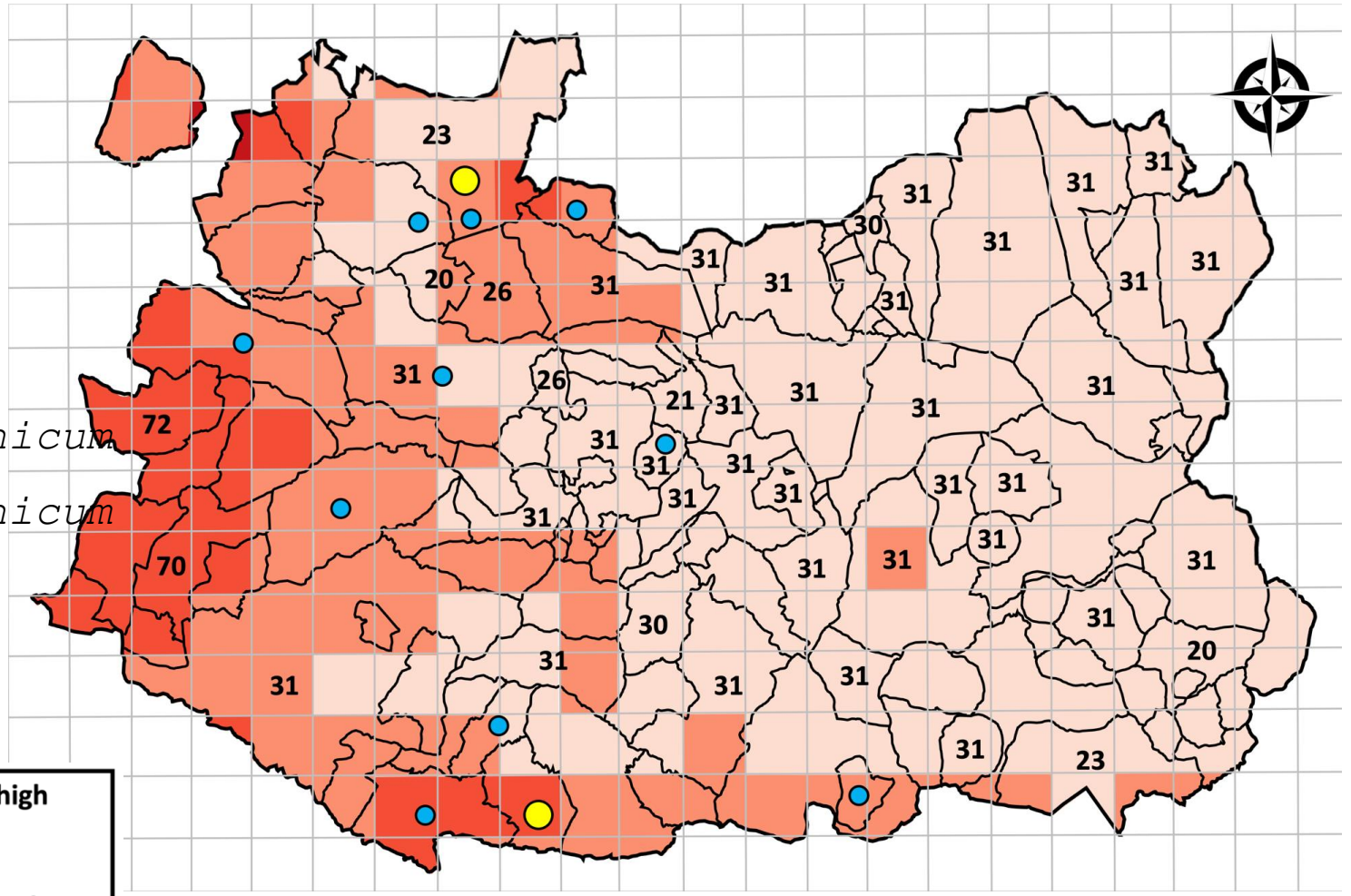
Transboundary and Emerging Diseases WILEY

The spatial pattern of human exposure to Crimean–Congo haemorrhagic fever virus is not consistent with red deer-based risk predictions

Mario Frías[1,2] | Raúl Cuadrado-Matías[3] | María del Castillo Jarilla-Fernández[4,5] | Pedro López-López[1,2] | Laia Casades-Martí[3] | Elena Madrigal[4] | Antonio Rivero[1,2] | Antonio Rivero-Juárez[1,2] | Francisco Ruiz-Fons[3]

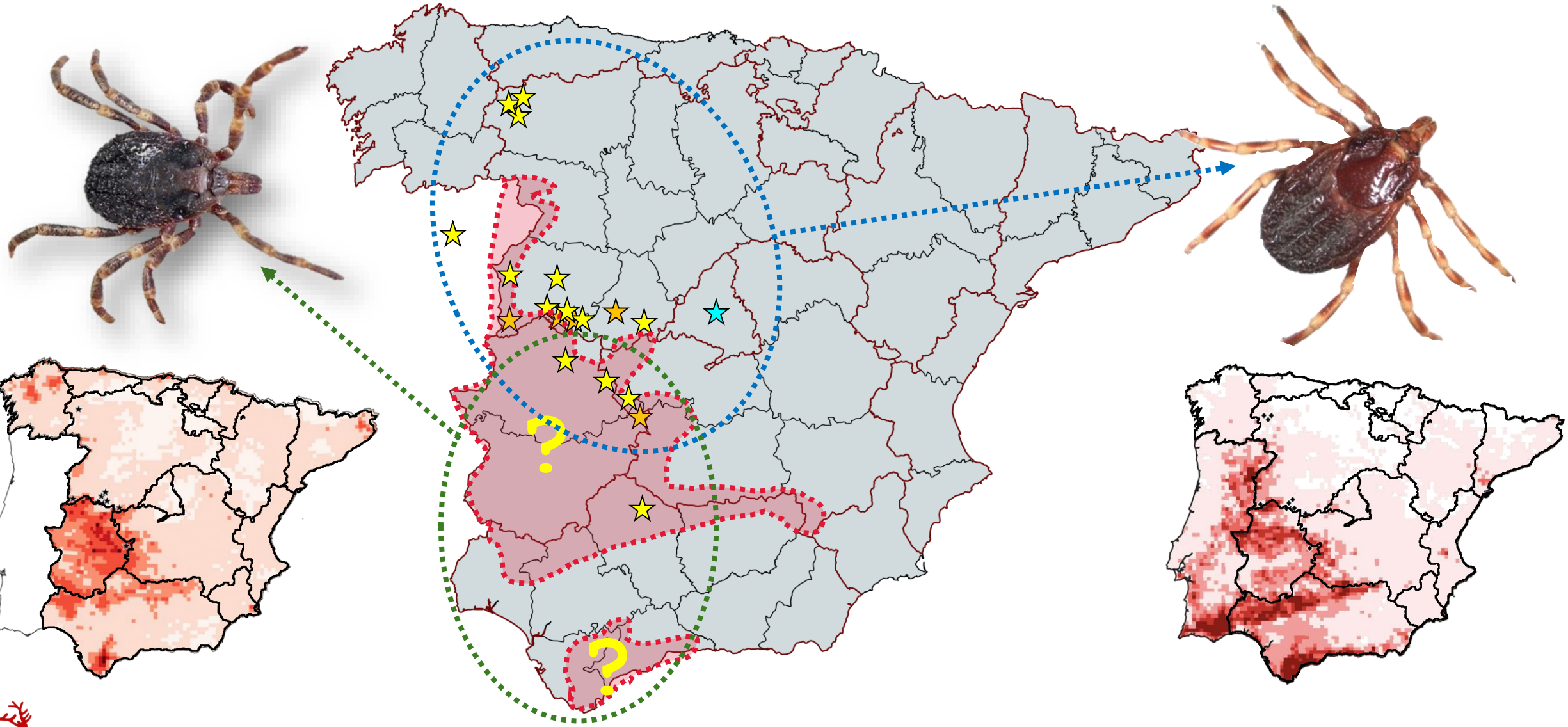
PCR− *Hy. lusitanicum*

PCR+ *Hy. lusitanicum*



1,384 human sera (Blood donors)
All antibody-negative

Is CCHFV transmission linked to *Hyalomma lusitanicum*??



Is CCHFV transmission linked to *Hyalomma lusitanicum*??

insects

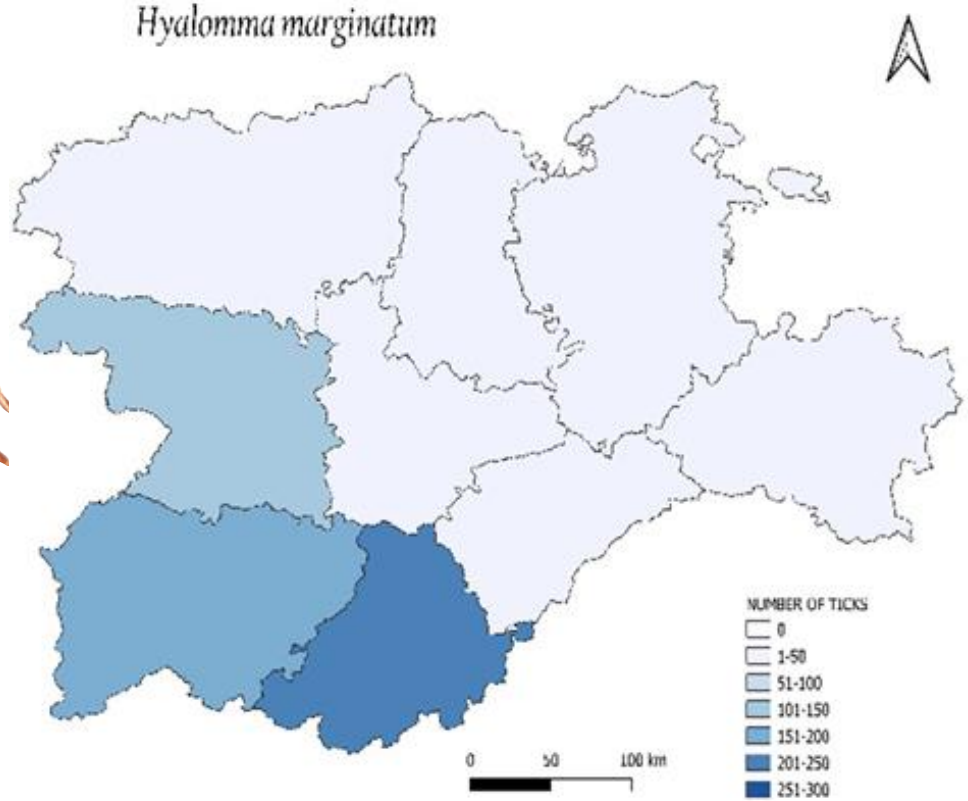
MDPI

Article

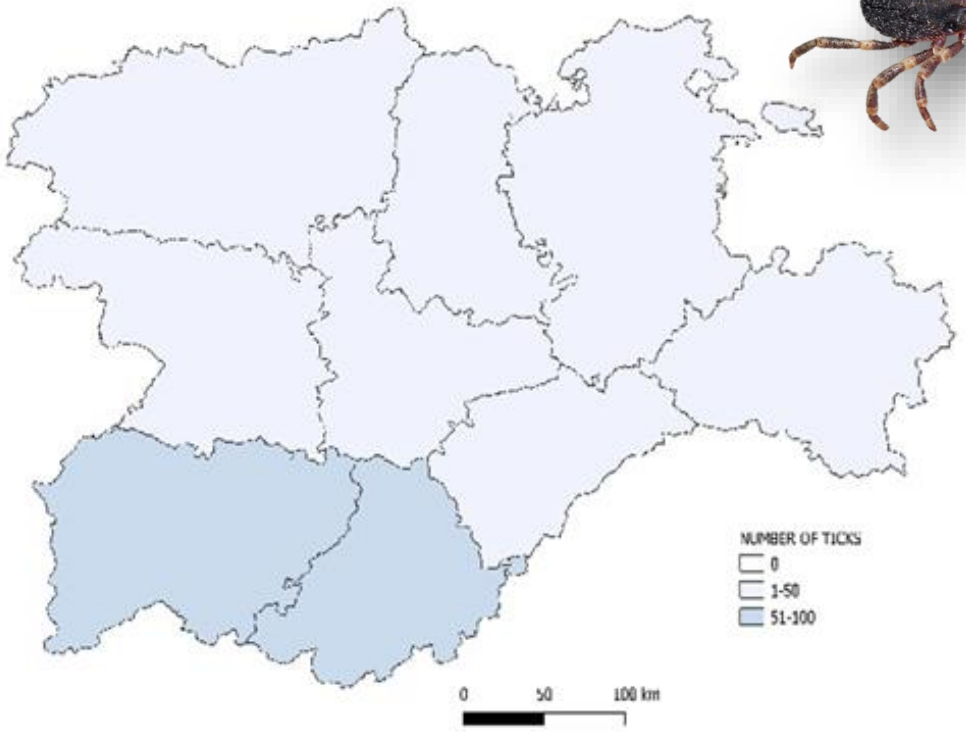
Identification and Distribution of Human-Biting Ticks in Northwestern Spain

María Carmen Vieira Lista [1], Moncef Belhassen-García [1,2,*], María Belén Vicente Santiago [1], Javier Sánchez-Montejo [1], Carlos Pedroza Pérez [1], Lía Carolina Monsalve Arteaga [3], Zaida Herrador [4], Rufino del Álamo-Sanz [5], Agustin Benito [4], Julio David Soto López [1] and Antonio Muro [1,*]

Hyalomma marginatum

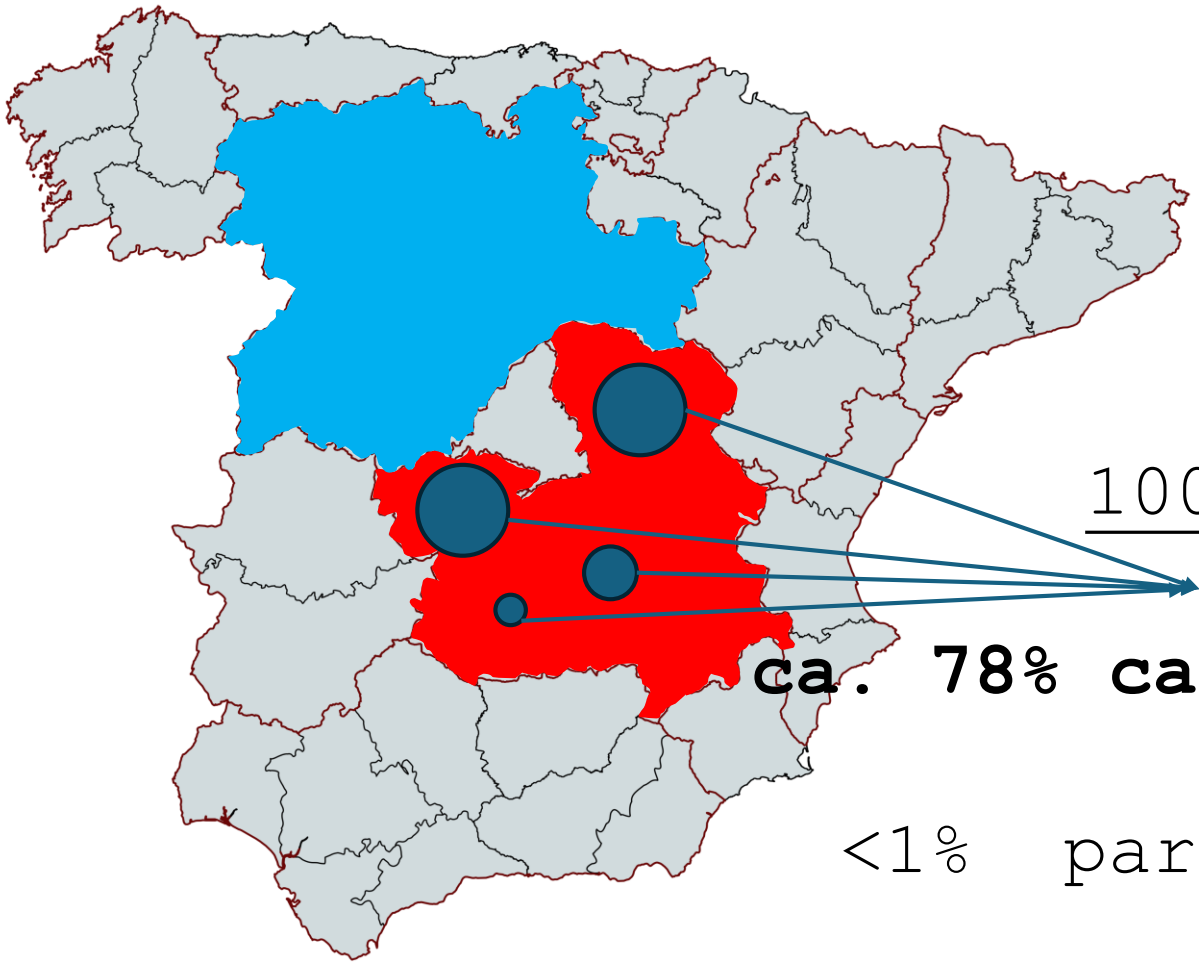


Hyalomma lusitanicum



Is CCHFV transmission linked to *Hyalomma lusitanicum*??

Ruiz-Fons F.
unpublished data



100 patients reporting ticks

ca. 78% carrying adult *Hyalomma lusitan*

<1% parasitised by *Hyalomma marginat*

Ticks & Crimean-Congo haemorrhagic fever virus ecology to predict disease expansion

Dr. Francisco Ruiz Fons

irec

CSIC

UCLM Universidad de Castilla-La Mancha

Castilla-La Mancha

GOBIERNO DE ESPAÑA MINISTERIO DE SANIDAD

MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

AGENCIA ESTATAL DE INVESTIGACIÓN

Plan de Recuperación, Transformación y Resiliencia

MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO

GOBIERNO DE ESPAÑA

EU

ISIDORe

MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN

Thank You...

Training workshop on emerging infectious diseases – 2026 - Istanbul

25th and 26th March