

Occurrence and identification of *Ixodes ricinus* - borne pathogens in north-eastern Italy

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INTRODUCTION

In Europe, the main vector for tick-borne pathogens (TBPs) is *Ixodes ricinus*, the most common tick species in Italy, reaching the highest density in hilly and pre-alpine northern areas. In the same areas, the majority of human cases of Lyme borreliosis (LB) and tick-borne encephalitis (TBE) occur, while other infections as rickettsiosis, anaplasmosis and babesiosis are rarely reported. The aim of this study was to add new knowledge on the presence and occurrence of endemic and emergent pathogens in ticks in north-eastern Italy.

MATERIALS AND METHODS

From 2011 to 2017 ticks were collected by dragging in 20 municipalities (43 sites; 177 samplings) in Belluno province. Ticks were morphologically identified, pooled (adults individually, nymphs in pool from 1 to 13 and larvae in pool from 1 to 22) and molecularly processed (rtPCR and sequencing) for the pathogen identification.



RESULTS

- Nine different pathogens were found in *I. ricinus* to be circulating in the Belluno province (Tab. 1). Co-infections are displayed in Tab. 2.
- More than 38% of analyzed pool resulted positive for TBPs.
- Positivity was found in 85% of monitored municipalities (Fig. 1). In each municipality, the presence of TBPs varied from one to seven different pathogens in the same year.

TBPs	Larvae	Nymphs	Adults	Total
<i>Rickettsia helvetica</i>	3 (12.00)	66 (22.30)	16 (5.82)	85 (14.26)
<i>Rickettsia monacensis</i>	0	7 (2.36)	5 (1.82)	12 (2.01)
<i>Borrelia afzelii</i>	0	33 (11.15)	7 (2.55)	40 (6.71)
<i>Borrelia burgdoferi s.s.</i>	0	10 (3.38)	18 (6.55)	28 (4.70)
<i>Borrelia garinii</i>	0	5 (1.69)	0	5 (0.84)
<i>Borrelia valaisiana</i>	0	4 (1.35)	2 (0.73)	6 (1.01)
<i>Anaplasma phagocytophilum</i>	0	54 (18.24)	21 (7.64)	75 (12.58)
<i>Candidatus Neoehrlichia mikurensis</i>	1 (4.00)	31 (10.47)	8 (2.91)	40 (6.71)
<i>Babesia venatorum</i>	0	1 (0.34)	0	1 (0.17)
TBE Virus	0	0	0	0
Total	4 (16.00)	211 (71.28)	77 (28.02)	292 (48.99)

Table 1: TBPs Identified, number and % of positive pool for each pathogen in tick stages.

Stadium	N. specimen and N. pool	N. pool negative	N. pool positive for 1 TBPs	N. pool positive for 2 TBPs	N. pool positive for 3 TBPs
Larvae	331 (25)	21 (84.00)	4 (16.00)	0	0
Nymphs	2062 (296)	143 (48.31)	103 (34.80)	42 (14.19)	8 (2.70)
Adults	275 (275)	203 (73.81)	67 (24.36)	5 (1.82)	0
Total	2668 (596)	367 (61.57)	174 (29.19)	47 (7.89)	8 (1.34)

Table 2: Number of specimen collected and description of pool positivity for TBPs in tick stages.

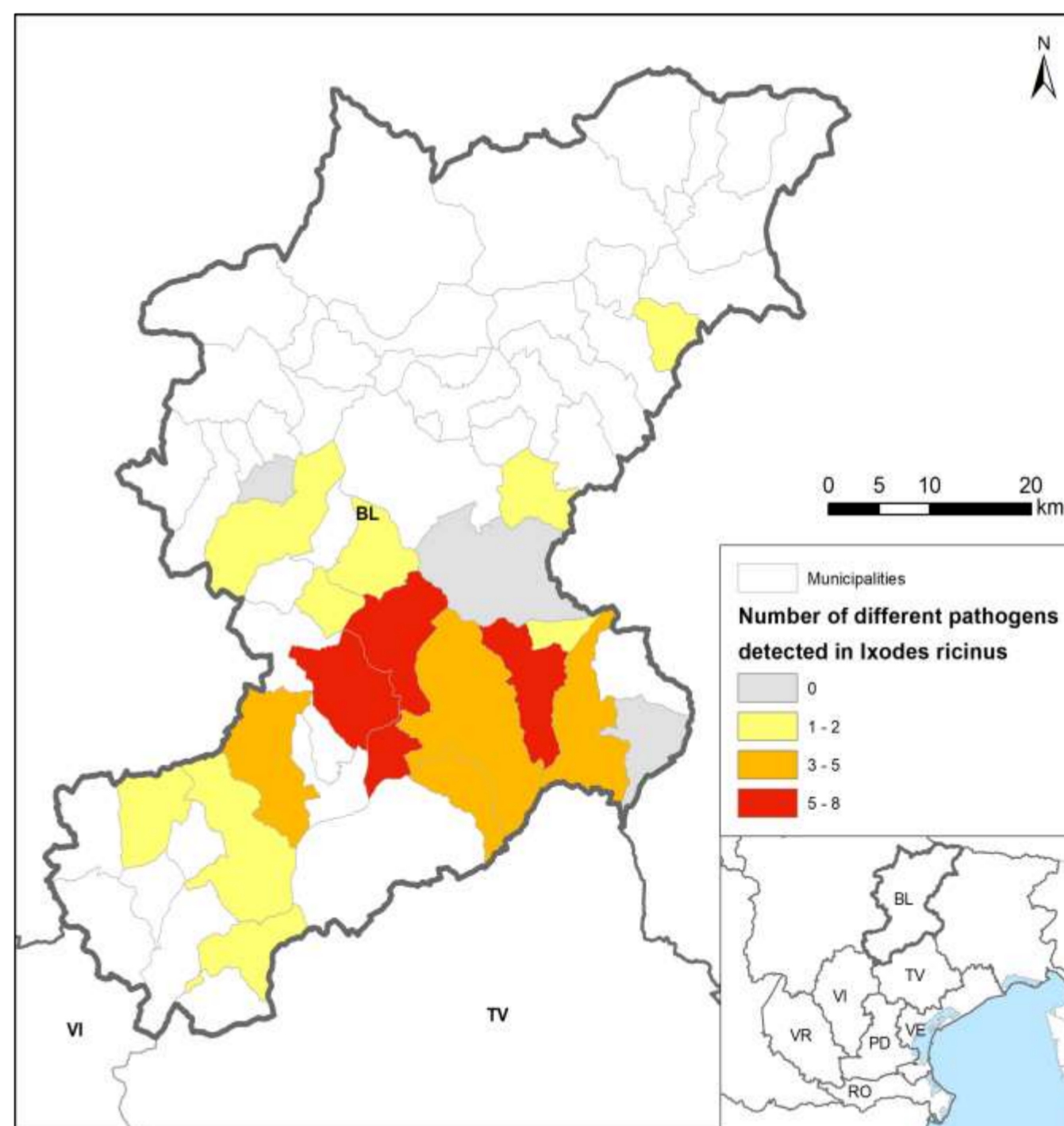


Figure 1: Occurrence of TBPs in monitored municipalities during 2011-2017.

CONCLUSIONS

Based on these results Belluno province shows to be an area with high circulation of TBPs. The present study indicates that the molecular screening of TBPs in questing ticks remains an efficient system for monitoring the circulation of tick-borne diseases in a specific area. Our results also suggest to considering *Rickettsia* and *Anaplasma phagocytophilum* in human cases that are not classified as LB or TBE, due to the high prevalence of these pathogens in ticks.