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Hidden interactions in ticks: Co-infection patterns of *Borrelia* spp. as indicators of TBEV microfoci

Inhalt

The ecological mechanisms underlying the spatial restriction of tick-borne encephalitis virus (TBEV) foci remain poorly understood. As *Ixodes ricinus* frequently carries multiple pathogens, interactions between *Borrelia* spp. and TBEV may contribute to focal virus persistence. Therefore, co-infection patterns and *Borrelia* species composition were investigated in relation to TBEV, in different hotspots in southern Germany. Between 2023 and 2025, 5,585 *I. ricinus* ticks from TBEV hotspots and adjacent TBEV-free sites in Stuttgart, Flappach, and Wangen in South Germany were screened using PCR methods. Overall, *Borrelia* spp. were detected in 23.4% of ticks, whereas TBEV prevalence in hotspots was low (0.4%; 15/3,535). *Borrelia afzelii* was the predominant species. Ticks collected from TBEV hotspots showed a significantly higher probability of *Borrelia* infection compared to TBEV-free sites ($p = 0.034$; $n = 3,535$). While the presence of *B. afzelii* significantly increased the probability of TBEV detection ($p = 0.034$), *B. burgdorferi* s.s. showed a positive but insignificant association ($p = 0.095$). Co-infections occurred in six of fifteen TBEV-positive ticks. Although these associations are consistent with shared reservoir hosts and overlapping transmission cycles, they provide valuable insights into the ecological structure of TBEV microfoci. *Borrelia* composition may represent an ecological indicator of environmental conditions supporting long-term TBEV persistence.

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Ixodes ricinus, *Borrelia*, TBE-Virus, Germany, Co-infections,

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Yes, I am a Junior Scientist.

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