Federation of Veterinarians of Europe

Increased public health risk of Tick-Borne Encephalitis (TBE) in Europe

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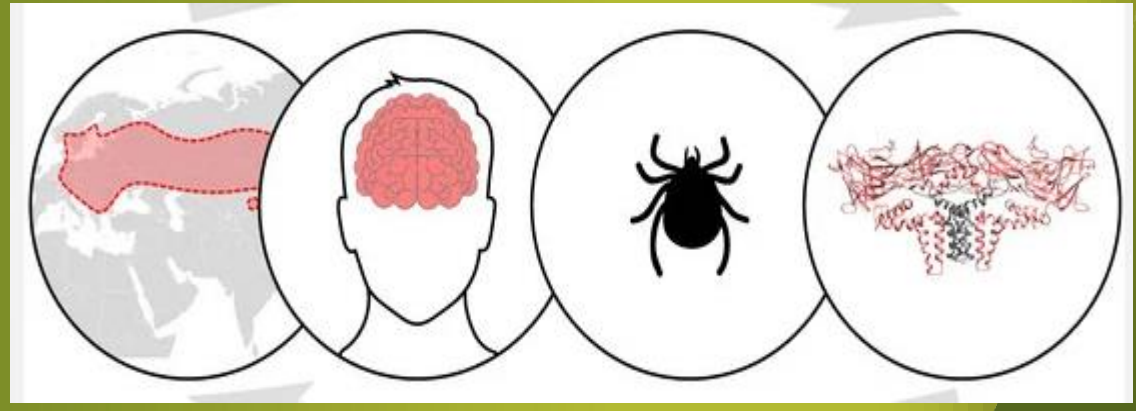
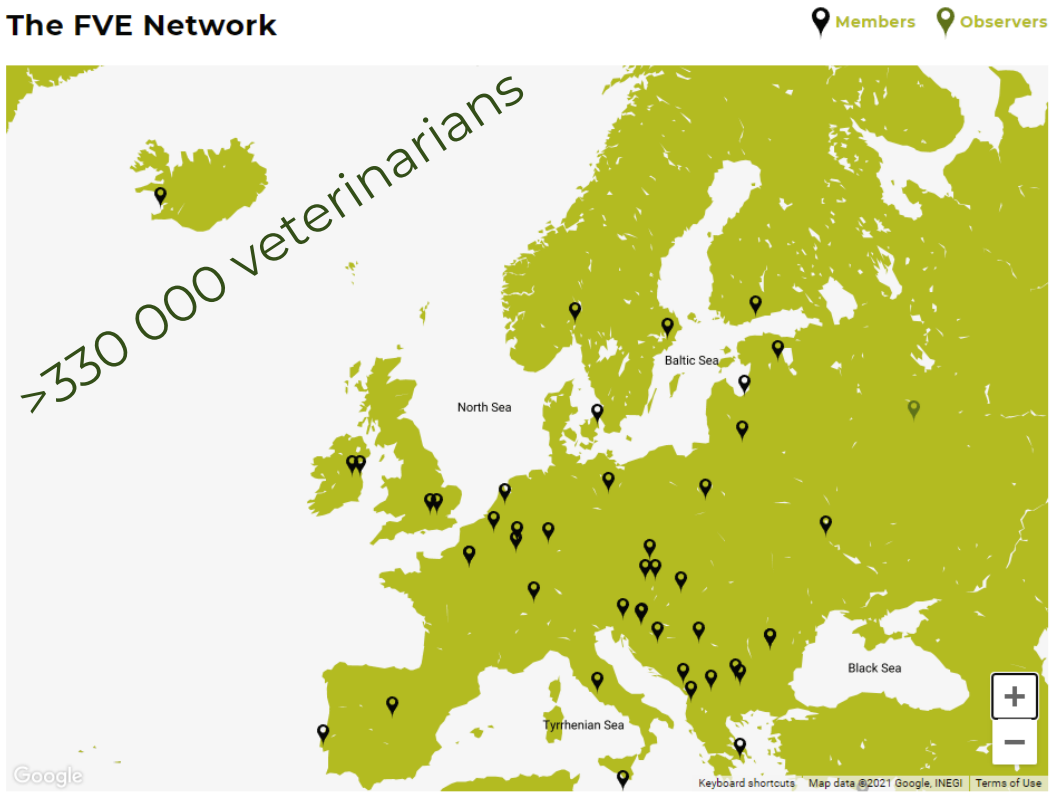


EFSA Stakeholder Discussion Group on Emerging Risk meeting, Parma, 4-5 June 2025

THE FEDERATION OF VETERINARIANS OF EUROPE



47 national associations

38 European countries

4 Sections
- UEVP (*Practitioners*)
- UEVH (*Hygienists – Public Health Officers*)
- EASVO (*Veterinary State Officers*)
- EVERI (*Education, Research, Industry*)

FVE's mission

The European veterinary profession, embodied by FVE, **enhances animal health, animal welfare, public health and protect the environment** by promoting the veterinary profession.

Together with its members, FVE supports veterinarians in delivering their professional responsibilities to the best possible standards and ensures that veterinary expertise is recognised and valued by society.

Summary

- Emerging Arboviruses in Europe
- Tick-borne encephalitis human cases in Europe
- The vectors (tick) and transmission cycle
- TBE in Italy: increased animal and human notification case
- The role of raw milk and cheese
- TBE prevention and control: One Health Approach

Emerging Arboviruses in Europe

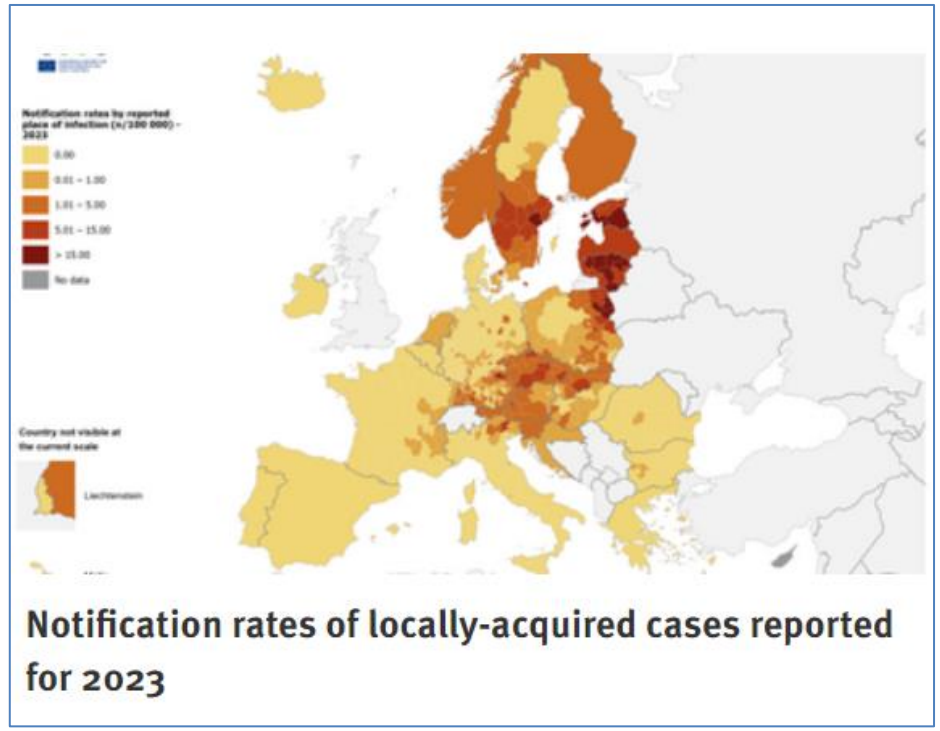
- viruses transmitted by arthropods pose a global public health threat
- sporadic cases or outbreaks caused by flavivirus (West Nile virus, TBEV) and phleboviruses are often reported in Europe
- primary or secondary vectors of these viruses are established in Europe and already expanding their latitude and altitude ranges
- incidence of arboviral diseases is expected to increase due to several anthropogenic and/or environmental factors (mainly climate change, which affects the survival and amplification of the arthropod vectors).

Tick borne encephalitis (TBE)

- is a zoonotic disease transmitted to humans by the bite of infected ticks
- it affects the central nervous system of humans and animals
- zoonotic virus of the *Flaviviridae* family
- 5 subtypes: Western European subtype (TBEV-EU), Far Eastern subtype (TBEV-FE); Siberian subtype (TBEV-Sib); Baikalian subtype (TBEV-Bkl); Himalayan subtype (TBEV-Him)
- endemic in several regions of Europe (detected in 27 countries) and Asia with an irregular distribution within unstable foci.

TBE human cases in Europe

- hotspots are mainly concentrated in Central, eastern, and Northern Europe
- several regions have recently reported their first human cases or noted an increase in infections
- although is recognized as a major public health problem in Europe, the true burden of TBE is potentially underestimated
- 2022: 30 EU/EEA member countries reported 3516 TBE cases with a 14% increase in notifications from 2021 to 2022 (0.8/100.000/year)
- cases are on the rise mainly due to environmental, ecological and other factors that increase the risk of human exposure to infected ticks (ECDC, 2022)



(ECDC, 2025): as of March 2025

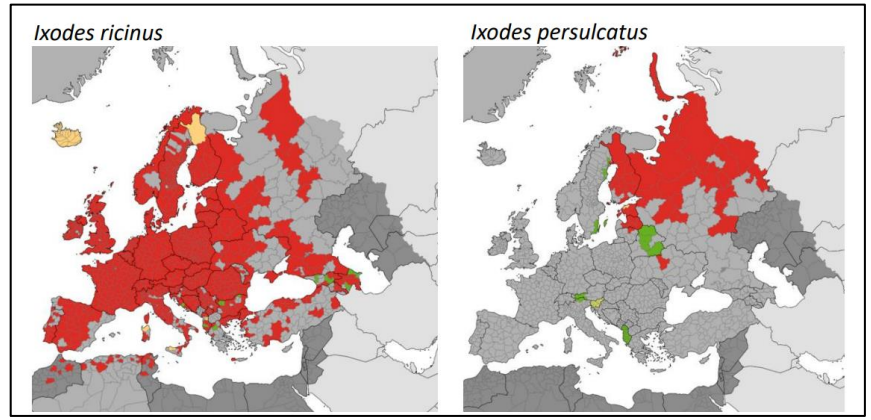
TBE human cases in Europe

- European Centre for Disease Prevention and Control (ECDC)
  - increase in the incidence of TBE
  - expansion of the geographic range of the vector
  - significant impact on public health

- EFSA: activities on emerging risks in 2020
  - (ID0428). Risk of TBEV due to raw goat milk consumption in France

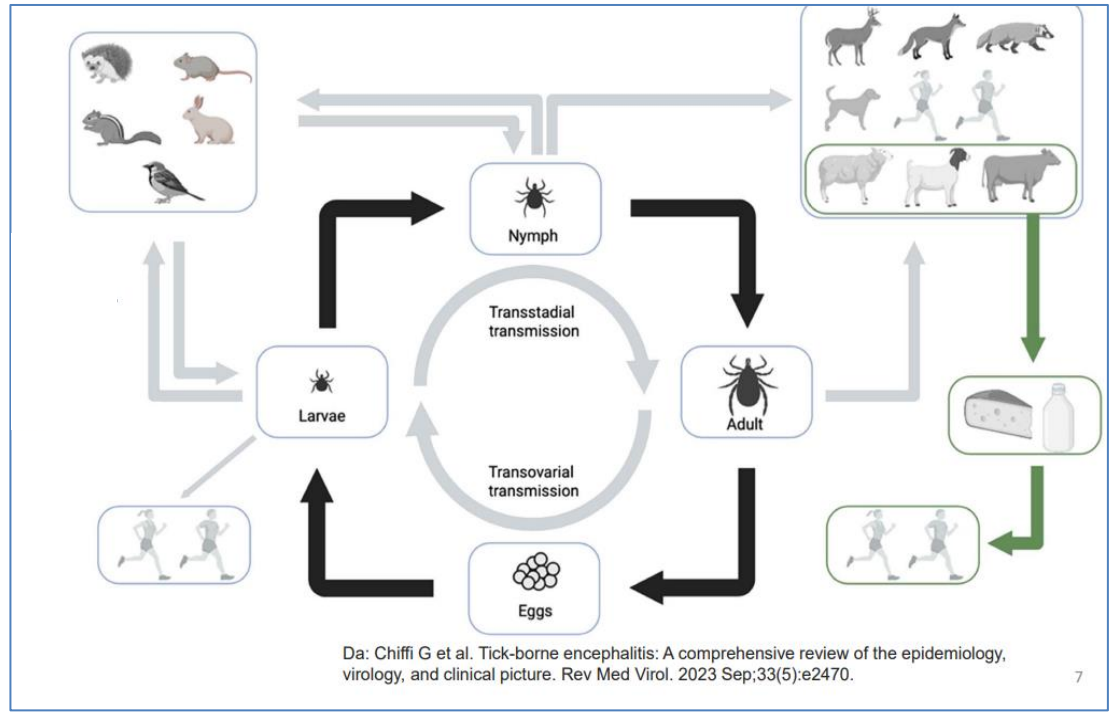
Ixodes ricinus: primary TBE vector

- *Ixodes ricinus* (wood tick) and *Ixodes persulcatus*
  - present in wooded areas (broadleaf) in Italy, more widespread in Alpine and pre-Alpine forested or grassy areas
- distribution of vectors in Europe
- circulation of TBEV is closely related to the presence of the animal reservoir (or carrier) and the vector
- due to their long life cycle (1-3 years) ticks are both vectors and reservoirs of the virus



TBEv transmission cycle

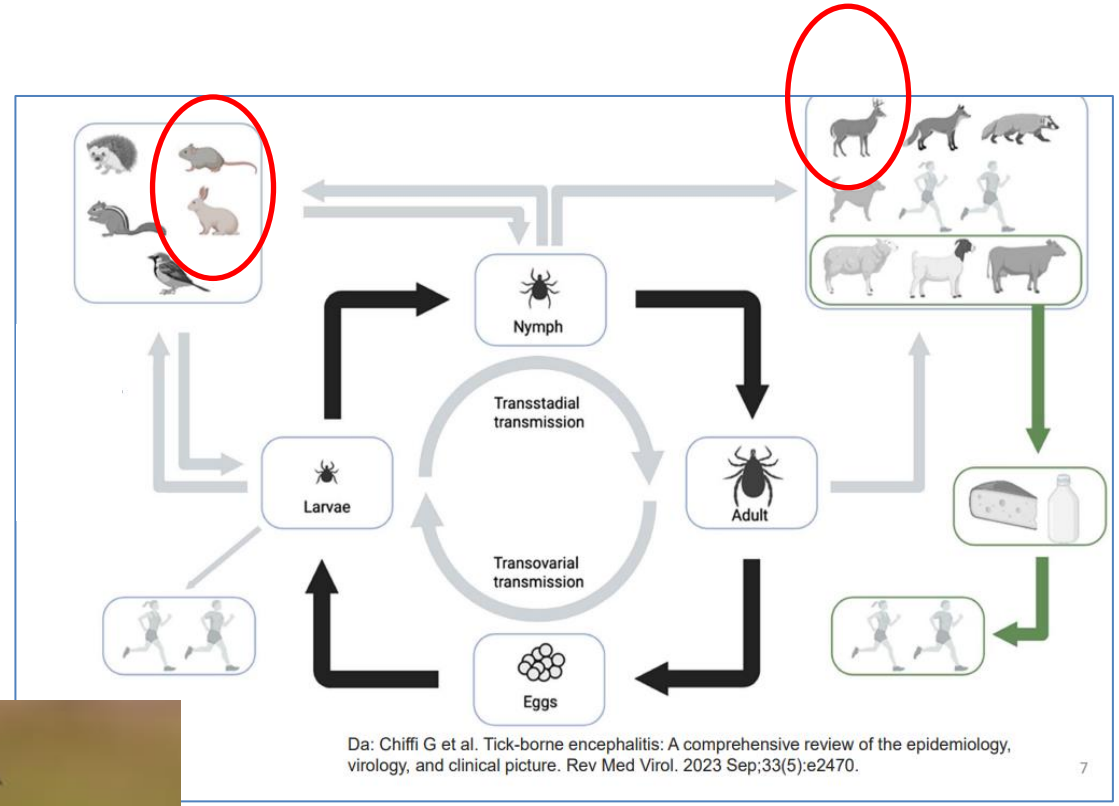
- *Ixodes ricinus* feeds on reptiles, birds, and mammals (triphasic: 3 hosts), different stages (larvae, nymph, adult)
- vertically (trans-ovarian and transstadial)
- horizontally
  - by viremic means (from an infected host to an uninfected tick)
  - non-viremic means, also called "co-feeding"
- reservoir hosts, transmission can occur both pre-natally and post-natally through breastfeeding



Da: Chiffi G et al. Tick-borne encephalitis: A comprehensive review of the epidemiology, virology, and clinical picture. Rev Med Virol. 2023 Sep;33(5):e2470.

TBEv transmission cycle

- key small rodent species serve as competent TBEV reservoir that support both virus circulation and feeding ticks
- cervids (deer) non-competent hosts, can act as amplifiers of vector population in forested areas by moving adult ticks over long distances (dilution effect)
- migratory bird species contribute to the geographical distribution of TBEV infected ticks

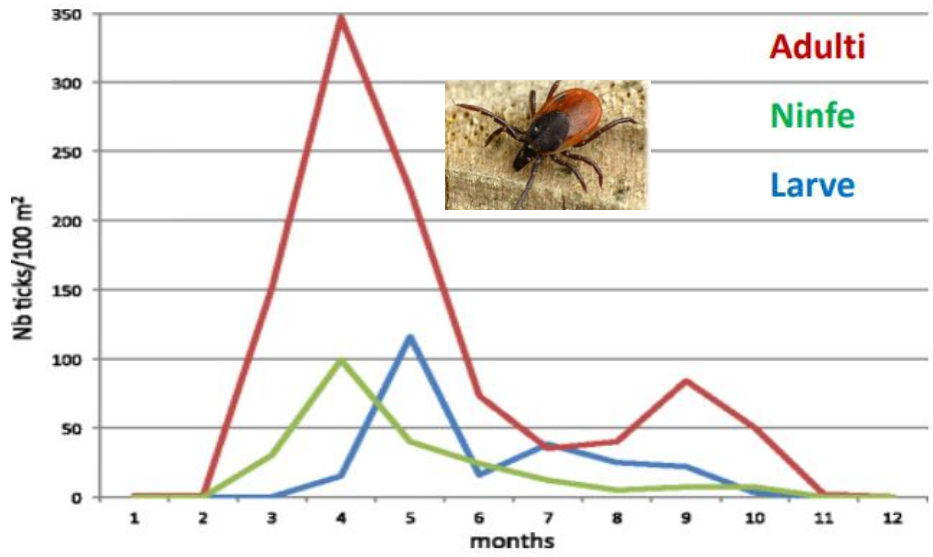


Da: Chiffi G et al. Tick-borne encephalitis: A comprehensive review of the epidemiology, virology, and clinical picture. Rev Med Virol. 2023 Sep;33(5):e2470.

TBEV transmission cycle

- two peaks of activity: spring and autumn (Sweden, Denmark, France, Italy). ECDC (2022): 90% of confirmed cases occurred between June and November, with July having the highest number of reported cases (n=800).

- cooling in autumn plays a key role in TBEV epidemiology (behavioural diapause)



TBEV transmission to humans

- humans are accidental and dead-end hosts
- viral transmission might occurs via:
  - bite from an infected tick
  - handling of infected material
  - blood transfusion
  - ingestion of raw milk and dairy products derived from viraemic domestic ruminants (goats and cow) (1%)
  - breastfeeding

Source. Pfeffer etr al.. 2011)

TBEV in raw milk or raw milk cheese

- raw milk from infected goats, sheep, or cows identified as a source of TBEV transmission to humans: Slovack, France (2022) and Germany
- after exposure by the alimentary route i.p. can be shorter, usually 3–4 days and even as short as two 2 days
- estimated prevalence of TBEV in individual raw milk (6%) and cheese (3%)
- TBEV prevalence in bulk milk was very heterogeneous, with most values either 0% or 100%
- variable prevalence reported in the studies may reflect the focal nature of TBEV.

Review › Zoonoses Public Health. 2025 May;72(3):248-258. doi: 10.1111/zph.13216. Epub 2025 Feb 23.

A Systematic Review on the Prevalence of Tick-Borne Encephalitis Virus in Milk and Milk Products in Europe

Laura Tomassone [1], Elisa Martello [2], Alessandro Mannelli [1], Aurora Vicentini [1], Céline M Gossner [3], Jo Leonardi-Bee [2]

Affiliations + expand

PMID: 39988728 PMCID: PMC11967290 DOI: 10.1111/zph.13216

TBEV beyond tick bites

- infants can contract TBEV from infected mother via breast milk
- infant symptoms vary from asymptomatic/mild to severe, including fever, irritability, poor feeding, lethargy, and neurological issues like seizures and encephalitis
- risk of TBEV transmission through breast milk is low

Literature Review Article

Breast Milk: A Potential Route of Tick-Borne Encephalitis Virus Transmission from Mother to Infant

July 2023 · Cureus 15(7):e41590
DOI: 10.7759/cureus.41590

Rohit Dabas · Nandita Sharma · Avinash B Taksande · Show all 6 authors · Mayur Wanjari

TBEV infection in humans

- 70% of cases only minor symptoms (i.p. 7-28 days) (underreporting?)
- 30% of cases
  - first phase: flu-like symptoms such as high fever, severe headache, sore throat, tiredness, muscle and joint pain for 2-4 days
  - second phase (10-20%): CNS disorders (encephalitis, flaccid paralysis) with fatal outcome in 1% of cases
- children and younger subjects: milder course, with progressive increase in severity as age advances (40-50 yold)
- the biphasic form of TBE is more common in milk-borne cases

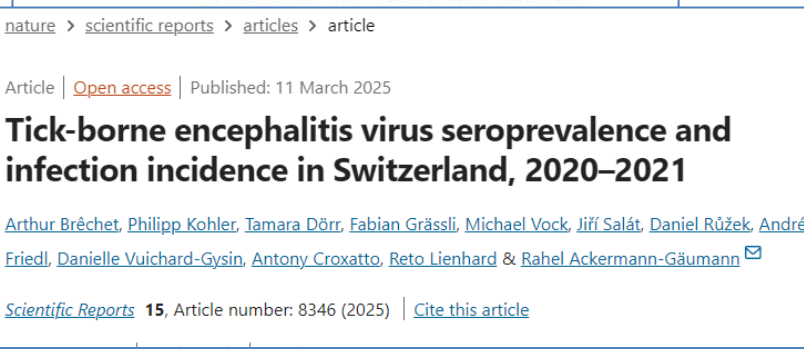
TBEV in humans (Switzerland)

- Monocentric observational study
  - TBEV the most frequently identified infectious cause, most cases clinically presenting meningoencephalitis (57%)
- TBEV seroprevalence study (2020-2021)
  - estimated annual incidence of infection was 735/100,000
  - seroreversion rate in unvaccinated individuals 30.3% within one year, which is almost ten times higher than in vaccinated individuals
  - undetected TBEV infections are common, and infection incidence is much higher than reported clinical cases.

BMC Neurology

RESEARCH ARTICLE Open Access

Meningitis, meningoencephalitis and encephalitis in Bern: an observational study of 258 patients



nature › scientific reports › articles › article

Article | Open access | Published: 11 March 2025

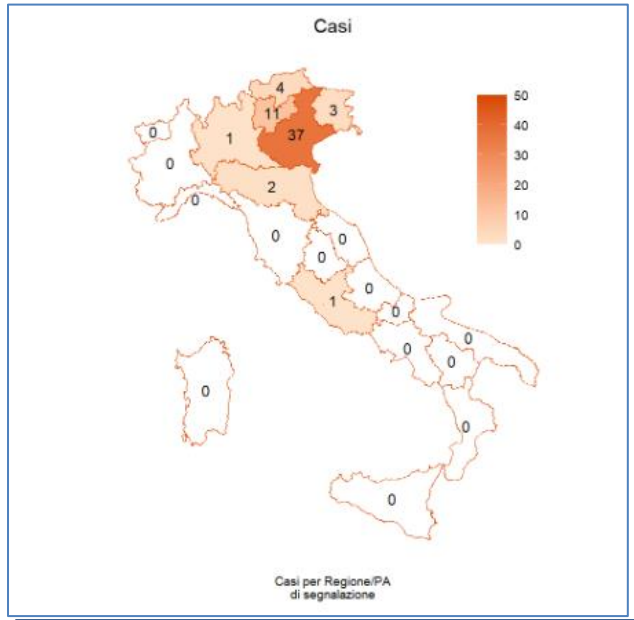
Tick-borne encephalitis virus seroprevalence and infection incidence in Switzerland, 2020–2021

Arthur Brêchet, Philipp Kohler, Tamara Dörr, Fabian Grässli, Michael Vock, Jiří Salát, Daniel Růžek, André Friedl, Danielle Vuichard-Gysin, Antony Croxatto, Reto Lienhard & Rahel Ackermann-Gäumann

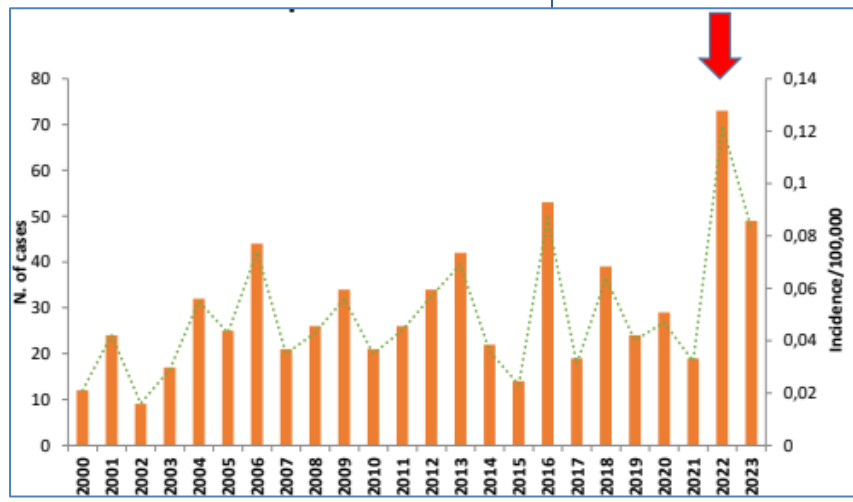
Scientific Reports **15**, Article number: 8346 (2025) | Cite this article

TBEV in humans – northern Italy

- TBE national surveillance program has been active since 2017
- active outbreaks of viral circulation especially in the North-East: Trento, Belluno, Gorizia
- 2018: 40 cases of confirmed neuro-invasive infection were reported in 4 Regions/PA: Friuli-Venezia Giulia, Veneto, Trento and Bolzano.
- 2022 (72 cases)
- why increased incidence?



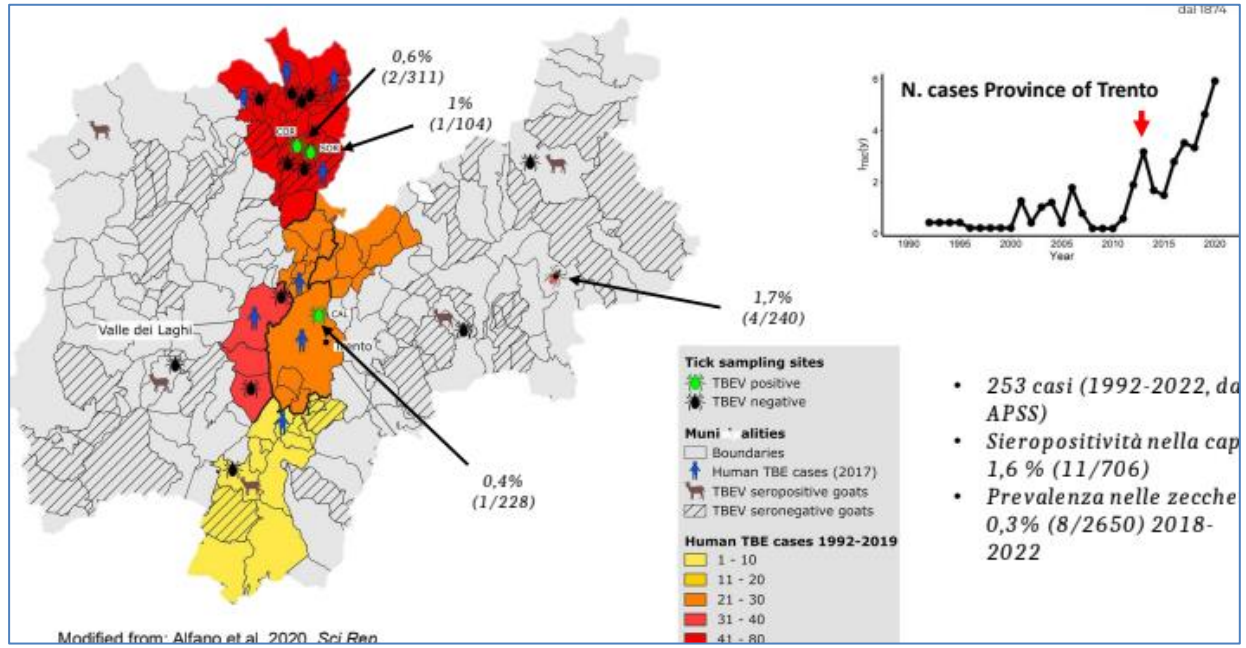
Confirmed cases of neuroinvasive TBE from 2017 to 2024 (as of May 12 2025)



From: Tagliapietra et al, 2024. TBE in Italy

TBEV in humans – northern Italy

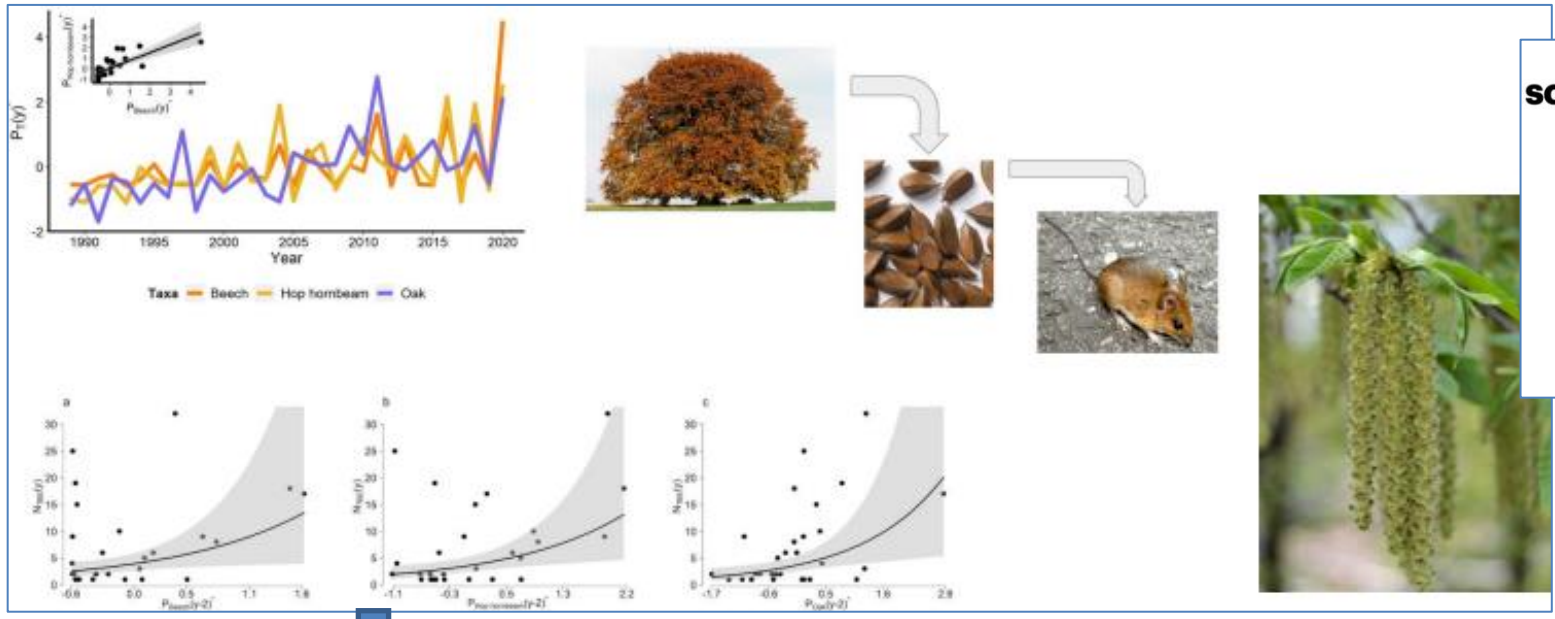
- Veneto Region: 2000-2023 (648 TBE human cases); 2006-2018 (266)
- Trentino Region:
  - 1992-2022: 253 cases
  - from 2024: 5 cases
- the rest of the country has been considered virus-free, with the exception of a single autochthonous case in Emilia-Romagna

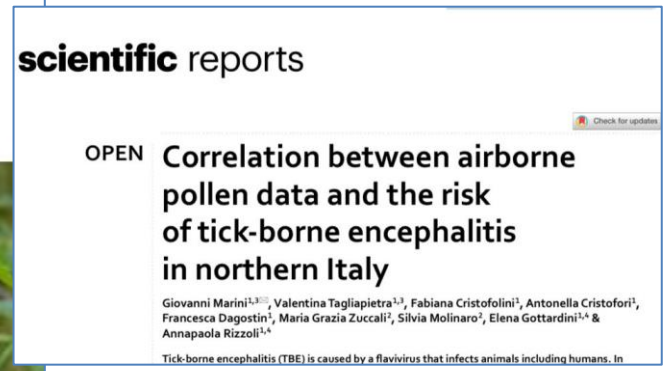


From: Tagliapietra et al, 2024. TBE in Italy

TBEV in humans – northern Italy

Prevention: early warning systems- Pollen concentration in the atmosphere





scientific reports

OPEN

Correlation between airborne pollen data and the risk of tick-borne encephalitis in northern Italy

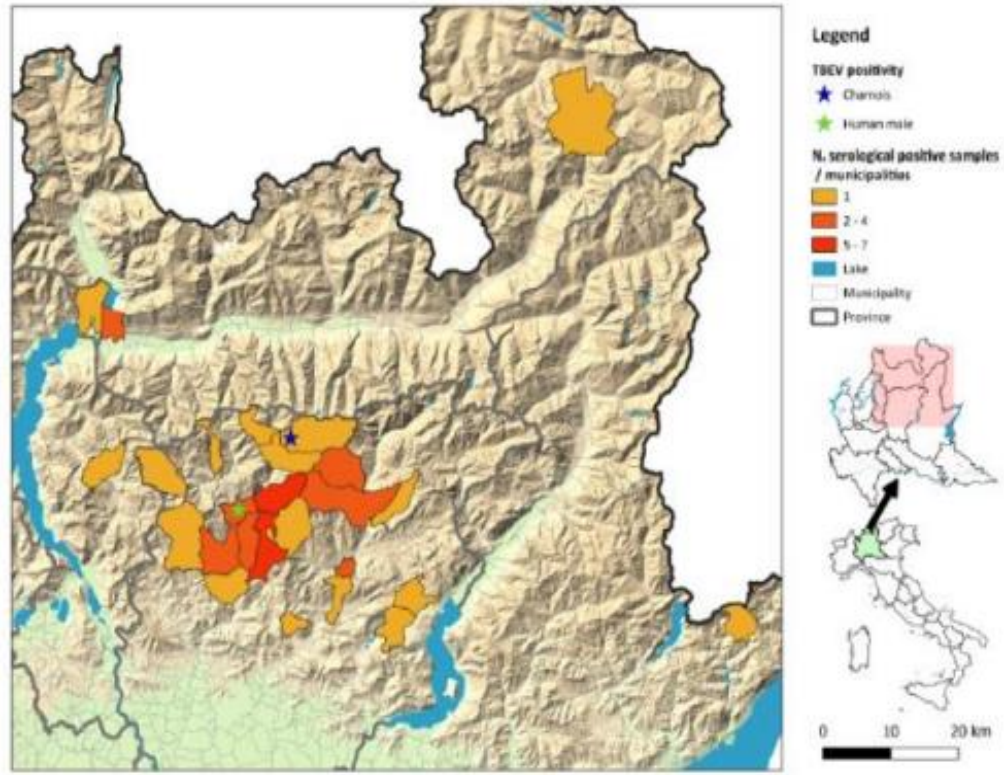
Giovanni Marini[1,3✉], Valentina Tagliapietra[1,3], Fabiana Cristofolini[1], Antonella Cristofori[1], Francesca Dagostin[1], Maria Grazia Zuccali[2], Silvia Molinaro[2], Elena Gottardini[1,4] & Annapaola Rizzoli[1,4]

Tick-borne encephalitis (TBE) is caused by a flavivirus that infects animals including humans. In

Relationship between the number of TBE human cases per year (y-axis) and the standardized total amount of recorded pollen per year with a 2-year lag (y-2) (x-axis). Dots: recorded TBE cases.

TBEV in human and animals - new areas of viral circulation

- Lombardy represents an area at risk for expansion of TBEV
- 47/1,954 samples from wild ungulates tested positive for TBEV antibodies
- 2023-2024: several reporting of chamois found positive for TBEV with neurologic symptoms (lack of coordination and equilibrium) and molecular positivity of *I. ricinus* ticks (same sequence).
- 2022: 1 TBEV human case in Lombardy (hunter reported a tick bite and displayed neurological symptoms)



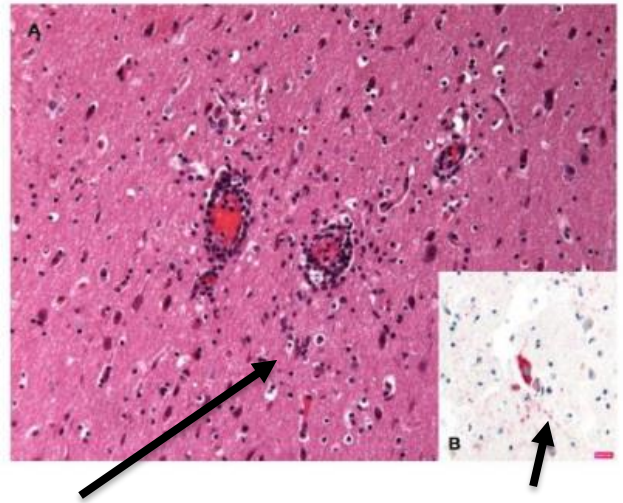
TBEV in chamois in Italy

Tick-Borne Encephalitis, Lombardy, Italy

Alessandra Gaffuri, Davide Sassera, Mattia Calzolari, Lucia Gibelli, Davide Lelli, Alessandra Tebaldi, Nadia Vicari, Alessandro Bianchi, Claudio Pigoli, Monica Cerioli, Luca Zandonà, Giorgio Varisco, Irene Bertoletti, Paola Prati

Tick-borne encephalitis was limited to northeast portions of Italy. We report in Lombardy, a populous region in the northwest, a chamois displaying clinical signs of tickborne encephalitis virus that had multiple virus-positive ticks attached, as well as a symptomatic man. Further, we show serologic evidence of viral circulation in the area.

serologic screening of wild ungulates confirmed the absence of TBEV in the Piedmont region (5). No data on TBEV in the most populous region of Italy, Lombardy, have been published recently. Considering Lombardy's position, bordering states (Switzerland) and regions where the pathogen is endemic, and the

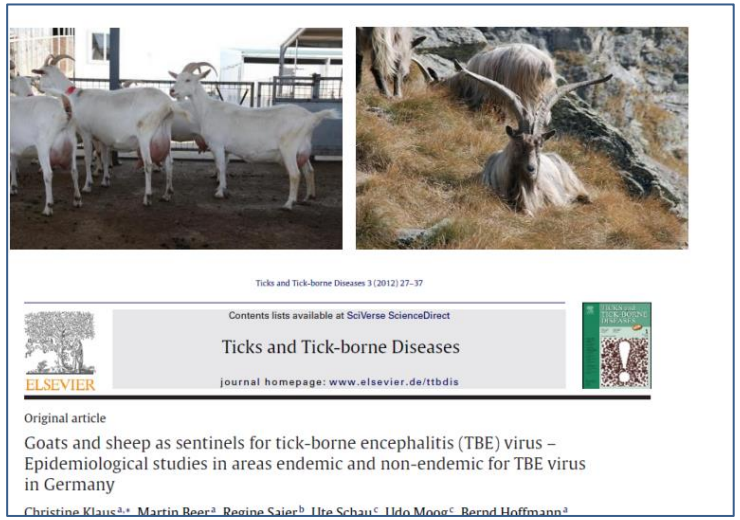


histopathologic findings of meningoencephaliits

Neuronal positivity for TBEv with imunohistochemistry;

TBEV in goats in Italy

- grazing goats with neurological symptoms shared the pasture with chamois
- positive for the detection of *Flavivirus* and TBEV by RT-PCR
- goats, sheep and wild ruminants are sentinel for TBEV
- tick TBEV positive
- serological positivity of the goats in the farm: all the positives refer to animals belonging to the group kept in pasture



Ticks and Tick-borne Diseases 3 (2012) 27–37

Contents lists available at SciVerse ScienceDirect

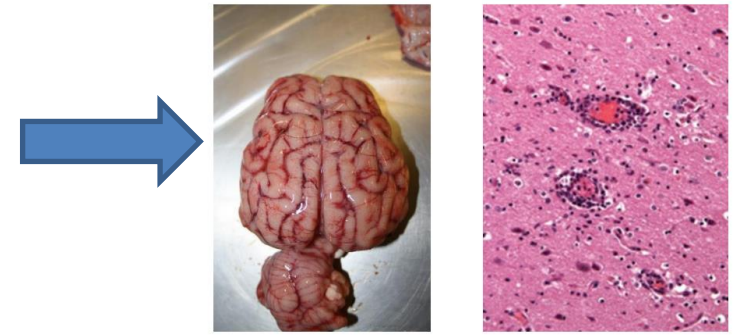
Ticks and Tick-borne Diseases

journal homepage: www.elsevier.de/ttbdis

Original article

Goats and sheep as sentinels for tick-borne encephalitis (TBE) virus – Epidemiological studies in areas endemic and non-endemic for TBE virus in Germany

Christine Klaus[a,*], Martin Beer[a], Regine Saier[b], Ute Schau[c], Udo Moog[c], Bernd Hoffmann[a]



lymphohistiocytic meningoencephalitis

TBEV in a deer in Italy

- 2022: first case of clinical TBE in a roe deer in Belluno (Veneto region)
- Veneto: endemic area where approximately 40% of all TBEV cases in Italy occur in the last decade
- Belluno: human clinical cases: 2023 (14), 2024 (19), 2025 (1)
  (source: Dip. Prev.Ulss 1)
- 20 human cases/year

Open Access Communication

Clinical Tick-Borne Encephalitis in a Roe Deer (*Capreolus capreolus* L.)

by Graziana Da Rold [1,2,*], Federica Obber [1,2], Isabella Monne [2,3], Adelaide Milani [2,3], Silvia Ravagnan [2,4], Federica Toniolo [2,4], Sofia Sgubin [2,4], Gianpiero Zamperin [2,3], Greta Foiani [2,5], Marta Vascellari [2,5], Petra Drzewniokova [2,6], Martina Castellan [2,6], Paola De Benedictis [2,6] and Carlo Vittorio Citterio [1,2]

[1] U.O. Ecopathology SCT2-Belluno, Istituto Zoprofilattico Sperimentale delle Venezie (IZSVe), Via Cappellari 44/A,

TBE surveillance and monitoring programs

- Lombardy Region Decree 3770 of 06/03/2024
  - health procedure for the management of TBEV positivity in the livestock sector
  - identification of pastures at risk based on available diagnostics
  - repellent antiparasitic treatment on affected dogs and livestock
  - notification of symptoms to the Veterinary Prevention Department by farmer, hunter, vets
  - sample collection by the veterinary service or under its supervision
  - management of TBE positivity in livestock farms

TBE outbreak in Italy: One Health Approach

- Regional plan for monitoring and control of TB diseases
  - registration of human tick bites on the regional portal
  - management by the Veterinary Department of animal cases of tick bite diagnostics by official lab (IZSLER) on ticks of domestic, farmed and wild animals.
  - management by the Medical Department of human cases arising from the bite of ticks
  - early detection in people and animals: development of epidemiological models

TBE outbreak in Italy: information and training activities

- The Veterinary and Animal Food Safety Departments and the Hygiene and Public Health Departments implement adequate training and information activities in area with high TBEV risk
  - previous positivity
  - presence of pastures and mountain pastures where viral circulation has been detected
  - detection of serological positivity in wild ungulates
  - identification of positivity for TBEV in ticks of flocks that frequent risk areas

Key takeways

- educate and raise the awareness of stakeholders and high-risk portions of the population (e.g., hunters, excursionists, farmers, vets)
- develop an One Health action plan against TBE
- educate health professionals particularly in regions in which diseases are newly emerging or anticipated to emerge
- implements surveillance (passive and active) and monitoring in animals and human in the most at-risk areas for preventing subsequent clinical cases of TBEV
- take immediate preventive measures to protect population (vector control, vaccination, and control of raw milk and traditional cheese making).