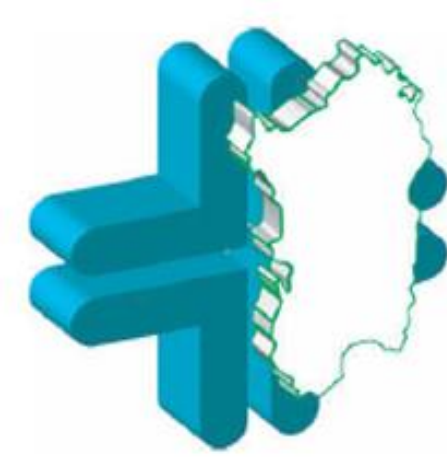




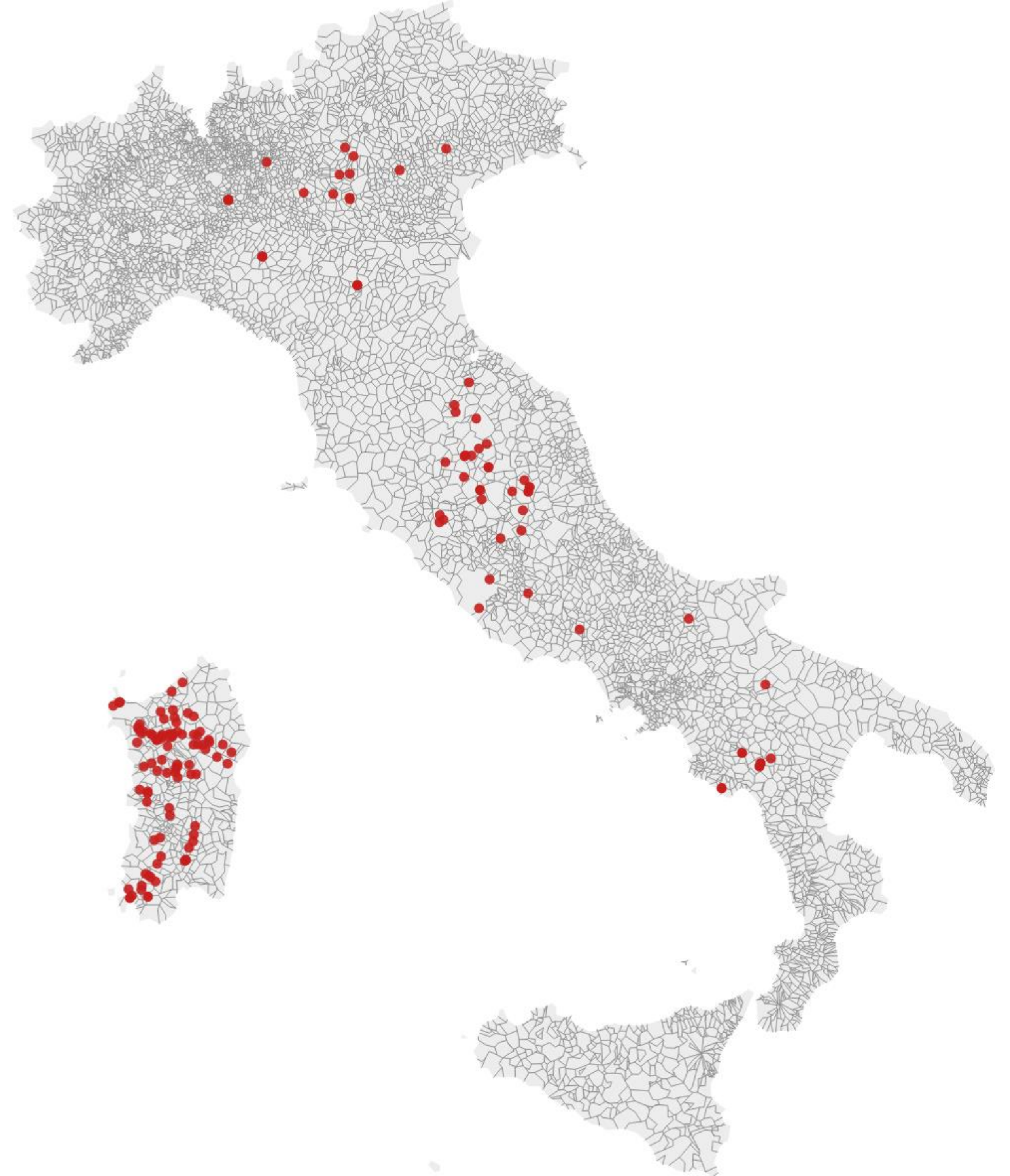
# Genetic variants of *Echinococcus granulosus* infecting sheep in Italy

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## Cistic Echinococcosis

Cystic Echinococcosis (CE) is caused by the larval form of *Echinococcus granulosus sensu lato* (s.l.). CE is considered an important public health concern and it was included by the World Health Organization (WHO) in a list of seven neglected zoonotic diseases requiring priority intervention. In Italy different epidemiological scenarios were reported depending on the geographical area and associated socio-economic main activities (1). Although in northern Italy the occurrence of *E. granulosus* s.s. is considered sporadic, in the southern regions and in Sardinia, CE prevalence reaches high levels (2).

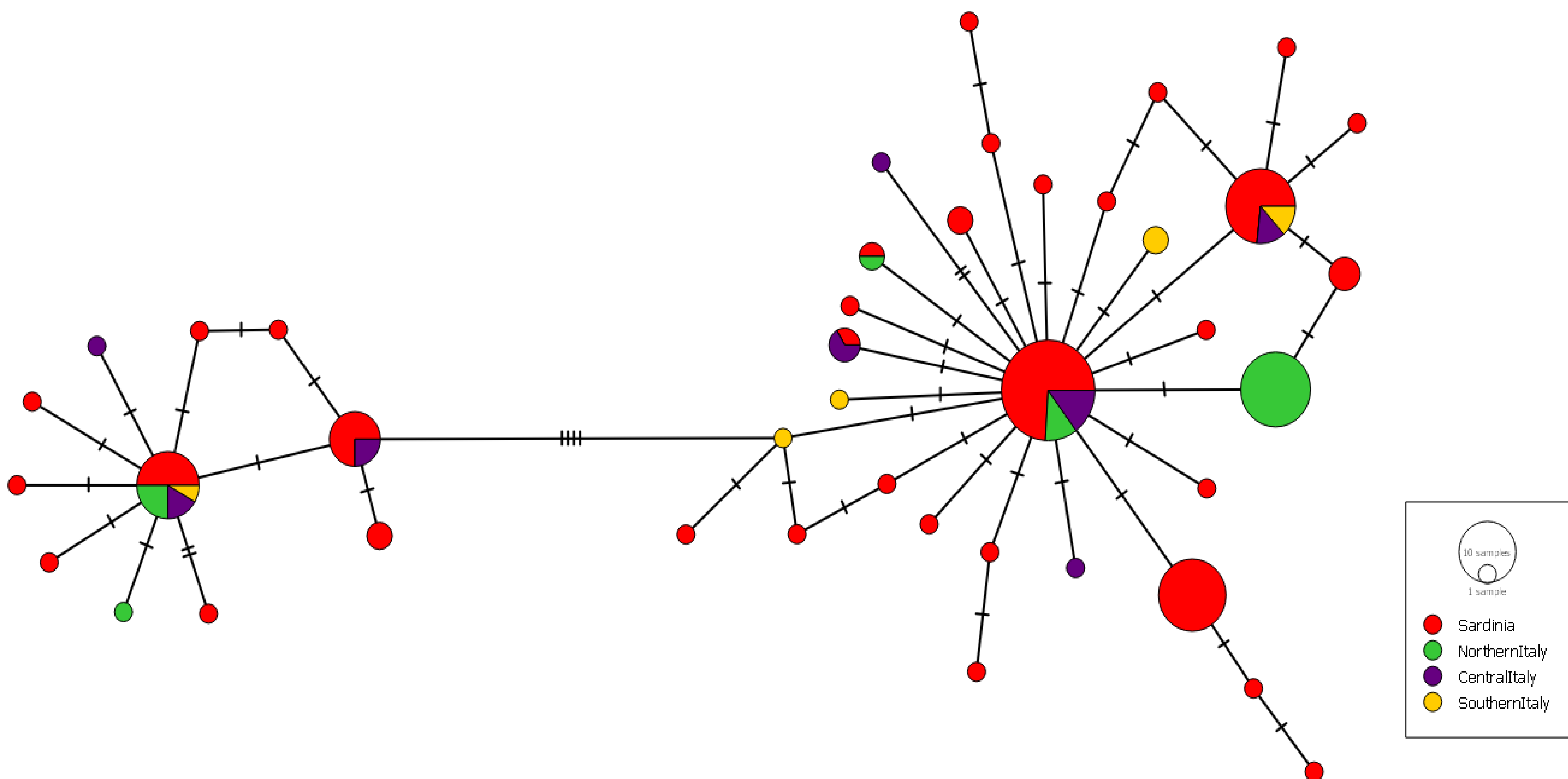


## Materials and Methods

We analysed CE cysts collected from infected sheep from various areas of mainland Italy and the island of Sardinia, with the main objective to investigate intergenotypic and intragenotypic variations of *E. granulosus* s.s. at national level. CE cysts were collected from slaughtered sheep following post mortem inspection at local abattoirs. Total genomic DNA was extracted from protoscoleces or germinal layers and amplification and sequencing of the partial mitochondrial gene *nad5* (3) were performed. A datasets of DNA sequences (n=128) obtained in this study were built for haplotype analysis based on a 670 bp fragment of the *nad5* region.

## Results

Ninety-eight Italian isolates were identified as *E. granulosus* s.s. G1 genotype (76.6%) while the other 30 sequences were assigned to G3 genotype (23.4%). As shown in the network analysis, we identified 42 haplotypes including 23 non-previously described haplotypes. G1 genotype was composed of 31 haplotypes with one central haplotype, including sequences from Sardinia, Northern Italy, and Central Italy, showing 100% homology with sequences from different countries (Europe, Southern America, Northern Africa, Central Asia, Oceania). G3 genotype was divided in 11 haplotypes with a most frequent haplotype including isolates (n= 12) from Sardinia, Northern Italy, Central Italy and Southern Italy.



## Conclusions

*E. granulosus* s.s. and in particular the G1 genotype, is responsible for the vast majority of human CE cases worldwide (88.44%) (4). Our results evidenced that G1 is the predominant genotype in sheep in Italy. Further phylogenetic studies on *E. granulosus* s.s. could help to improve our knowledge of the parasite, including transmission dynamics and host specificity, and possibly to better define more effective control strategies against the disease.

## References

- Loi F, Berchiulla P, Masu G, Masala G, Scaramozzino P, Carvelli A, et al. Prevalence estimation of Italian ovine cystic echinococcosis in slaughterhouses: A retrospective Bayesian data analysis, 2010–2015. PLOS ONE. 2019 Apr 1;14(4):e0214224.
- Piseddu T, Brundu D, Stegel G, Loi F, Rolesu S, Masu G, et al. The disease burden of human cystic echinococcosis based on HDRs from 2001 to 2014 in Italy. PLOS Neglected Tropical Diseases. 2017 Jul 26;11(7):e0005771.
- Kinkar L, Laurimäe T, Acosta-Jamett G, Andrusiuk V, Balkaya I, Casulli A, et al. Distinguishing *Echinococcus granulosus sensu stricto* genotypes G1 and G3 with confidence: A practical guide. Infection, Genetics and Evolution. 2018;64(June):178–84.
- Alvarez Rojas CA, Romig T, Lightowler MW. *Echinococcus granulosus sensu lato* genotypes infecting humans – review of current knowledge. International Journal for Parasitology. 2014; 44, 9–18.