ABSTRACT BOOK

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ONE HEALTH

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AIRBORNE POLLEN: A POTENTIAL WARNING ALERT FOR TICK-BORNE ENCEPHALITIS RISK

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Introduction

The circulation of tick-borne encephalitis virus (TBEv) depends on population dynamics of host tick and rodents, which in turn depend on nutrient resources. Tree seeds are the main food for rodents, and their fluctuating production is strongly correlated to pollen abundance. Our study aims to fill the gap and investigate whether airborne pollen is directly associated to recorded TBEv human cases in the Alpine biogeographical region.

Materials and Methods

We focused our study within the province of Trento (northern Italy, 6,000km^2, 500,000 inhabitants). The territory is included in the Alpine biogeographical region (EEA Report No 1/2002) and the main forest tree species growing within a 5-km radius from the pollen sampler are represented by hop-hornbeam (*Ostrya carpinifolia* Scop.), beech (*Fagus sylvatica* L.), spruce (*Picea abies* L.), pine (*Pinus sylvestris* L. and *P. nigra* J. F. Arnold), downy oak (*Quercus pubescens* Willd.), manna ash (*Fraxinus ornus* L.), and hazel (*Corylus avellana* L.). Airborne pollen concentration has been monitored since 1989 at Fondazione Edmund Mach, in San Michele all'Adige (Latitude 46.19 N, Longitude 11.13 E, 220 m a.s.l.), while TBEv human cases have been recorded since 1992 by the local Public Health Agency. Airborne pollen was sampled by a Hirst-type trap, processed, and analyzed following conventional techniques and standardized protocols (UNI EN 16868:2019). First, we statistically investigated the association between the annual total pollen concentration of the dominant arboreal plant taxa and the annual number of TBEv human cases (1989-2020) with

different time lags by univariate linear models. Consequently, we built a full model by considering all significant covariates, we computed all possible sub-models and finally we selected the best (the one with the lowest Akaike's Information Criterion score).

Results and Discussion

We found a significant positive association between pollen abundances for beech (p=0.04), oak p=0.012), hop hornbeam (p=0.013) and TBEv human cases with a two-year lag (Figure 1). All other lags and taxa resulted in non-significant relationships. Subsequently, we identified the best model, which considered only hop-hornbeam and oak pollen quantities, both with positive coefficients, consistently with the univariate analysis.

Conclusions

To the best of our knowledge, this is the first attempt at quantifying the potential relationship between airborne pollen abundances of tree species and TBEv infections, based on a three-decade time series of data. If validated at a larger spatial scale, pollen data might therefore be used to realize an early warning system for the risk of TBEv transmission, two years in advance. Moreover, as pollen monitoring is routinely performed worldwide at multiple sites and provides quantitative measures, the association between pollen abundances and TBEv infections could be replicated in different biogeographical regions.

References

EEA Report No 1/2002 https://www.eea.europa.eu/publications/report_2002_0524_154909

UNI EN 16868:2019 Ambient air - Sampling and analysis of airborne pollen grains and fungal spores for allergy networks - Volumetric Hirst method

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Figure 1