

QUANTIFYING THE IMPACT OF IMMATURE TICK CO-AGGREGATION ON TICK-BORNE PATHOGEN SPREAD

SIMON JOHNSTONE-ROBERTSON

Tick-borne pathogens pose a considerable disease burden in Europe and North America. Two key pathogens, namely *Borrelia burgdorferi* and tick-borne encephalitis (TBE) virus, are transmitted when older nymphal ticks infect younger larval ticks feeding on the same host, either indirectly (via systemic infection of the vertebrate host) or directly (when feeding in close proximity). Larval and nymphal ticks are often observed aggregating on the same minority of hosts, a tick feeding behaviour known as co-aggregation. Consequently, co-aggregation is likely an important mechanism in the spread and persistence of both pathogens. By representing the pattern of tick blood meals as a directed contact network, analytic expressions describing the relationship between co-aggregation, the basic reproduction number, R_0 , and the tick type reproduction number, R_{tt} , are derived. Simulations of *B. burgdorferi* and TBE virus transmission on theoretical tick-mouse contact networks are used to visualise these relationships and confirm that for both pathogens, co-aggregation increases the mean number of ticks infected per infectious tick, R_{tt} , and so too the likelihood of pathogen persistence. We conclude the talk by briefly discussing preliminary results obtained when using tick-burden data from the field to parameterise the analytic formulae and quantify the impact of co-aggregation.