Analysing Time Series for a Forecasting Model to the Dynamics of Aedes Aegypti Population Size

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Abstract : Aedes aegypti is present in the tropical and subtropical regions of the world and is a vector of several diseases such as dengue fever, yellow fever, chikungunya, zika etc. The growth in the number of arboviruses cases in the last decades became a matter of great concern worldwide. Meteorological factors like mean temperature and precipitation are known to influence the infestation by the species through effects on physiology and ecology, altering the fecundity, mortality, lifespan, dispersion behaviour and abundance of the vector. Models able to describe the dynamics of the vector population size should then take into account the meteorological variables. The relationship between meteorological factors and the population dynamics of Ae. aegypti adult females are studied to provide a good set of predictors to model the dynamics of the mosquito population size. The time-series data of capture of adult females of a public health surveillance program from the city of Lavras, MG, Brazil had its association with precipitation, humidity and temperature analysed through a set of statistical methods for time series analysis commonly adopted in Signal Processing, Information Theory and Neuroscience. Cross-correlation, multicollinearity test and whitened cross-correlation were applied to determine in which time lags would occur the influence of meteorological variables on the dynamics of the mosquito abundance. Among the findings, the studied case indicated strong collinearity between humidity and precipitation, and precipitation was selected to form a pair of descriptors together with temperature. In the techniques used, there were observed significant associations between infestation indicators and both temperature and precipitation in short, mid and long terms, evincing that those variables should be considered in entomological models and as public health indicators. A descriptive model used to test the results exhibits a strong correlation to data.

Keywords : Aedes aegypti, cross-correlation, multicollinearity, meteorological variables