PHC2018/05 - Using modelling to investigate the effectiveness of national surveillance monitoring aimed at detecting a *Xylella fastidiosa* outbreak in Scotland

Steven White (CEH), James Bullock (CEH), Stephen Cavers (CEH) and Daniel Chapman (University of Stirling)

Policy Summary

The likelihood for *Xylella fastidiosa* to be introduced to novel locations such as Scotland is increasing mainly due to an increase in global trade. Outbreaks in southern Europe has been devastating, especially in Puglia, Italy, where millions of olive trees have been infected and died. This economically important plant pathogen could have a significant impact on Scottish agricultural and horticultural trades and therefore understanding the potential spread of *X. fastidiosa* in Scotland is important for informing contingency planning.

In this report we build upon existing *X. fastidiosa* spread stochastic simulation models based on those used to investigate *Xylella* outbreaks in Italy, making assumptions about how the underlying epidemiology might change should the disease be introduced. Using this model, we investigate numerous theoretical surveillance strategies to determine the best strategy given Scotland's unique topology. It should be noted that the work presented here is the first time that we have applied the Italian *Xylella* model in the UK, and the work undertaken in this study is a precursor to that being done in the UK-wide BRIGIT project (https://www.jic.ac.uk/brigit/), which will build on this study.

The modelling, albeit with considerable scope for refined parameterisation to the Scottish context, shows that the best surveillance strategies are highly dependent on the whether the introduction of the infected plant is near to a nursery or other location that is deemed to be a likely source for introduction. In the event that the introduction of an infected plant is close to a location that has been determined to be a potential risk, then a concentrated risk-based surveillance with low-level national surveillance elsewhere is predicted to be the best strategy. By contrast, if the introduction is not near to a location that has been determined to be a potential risk (e.g. due to dispersal via plant sales; or other modes of introduction)

then a national surveillance strategy is predicted to work best in most cases. Risk-based surveillance was predicted to work well in some scenarios. This may be because the location of nurseries are located close to urban or woodland cover, which therefore suggests that risk-based surveillance will cover areas of a likely introduction, especially is the risk-based surveillance is sufficiently wide. However, we conclude that having a mixture of risk-based and national surveillance is likely to be the best option for detecting potential *X. fastidiosa* outbreaks in Scotland.

Since the Scottish environment is much cooler than the current southern European outbreak locations, it is likely that the bacteria will have a slower within-host growth rate, which is likely to slow the rate of host-to-host spread. Under these circumstances, the spread model indicates that detection of an outbreak will be more difficult. Therefore, surveillance strategies should take this into account.

We highlight that improved contingency planning could be achieved by further studies on host and vector distribution and densities, better understanding of how *X. fastidiosa* might proliferate in hosts in a Scottish environment, and a detailed assessment of how and where *X. fastidiosa* could potentially be introduced.