Aerobiology to fight Ash Dieback in Europe

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Ash Dieback is a tree pathogen caused by caused by a fungus called *Hynenoscyphus fraxineus (*previous termed *Chalara fraxinea)*, which is an Ascomycete fungus. The disease has spread into many areas in Europe. In countries like Denmark or Poland, most trees are already dead, infected or expected to die in a few years. In 2012 it was for the first time observed in the Eastern parts of UK, and it is now spreading throughout the country (Fig 1a). Optical detection of the spores from this species is very challenging as it is nearly impossible to separate this spore from other spores related to Ascomycete fungus, and management of the disease is limited.

It is expected that new detection methods and new modelling approaches can assists in the management of *Hynenoscyphus fraxineus* as well as other airborne pathogens that threaten European trees. Due to this, the UK research council has funded the project “New approaches for the early detection of tree health pests and pathogens” within the Tree health and Plant Biosecurity Initiative. The project with a total value of £1.9 million has a number of partners including University of Worcester. At Worcester this project is now entering the second phase. This focuses on field detection, genomic detection and combining modelling approaches from ecology, geography and atmospheric sciences.

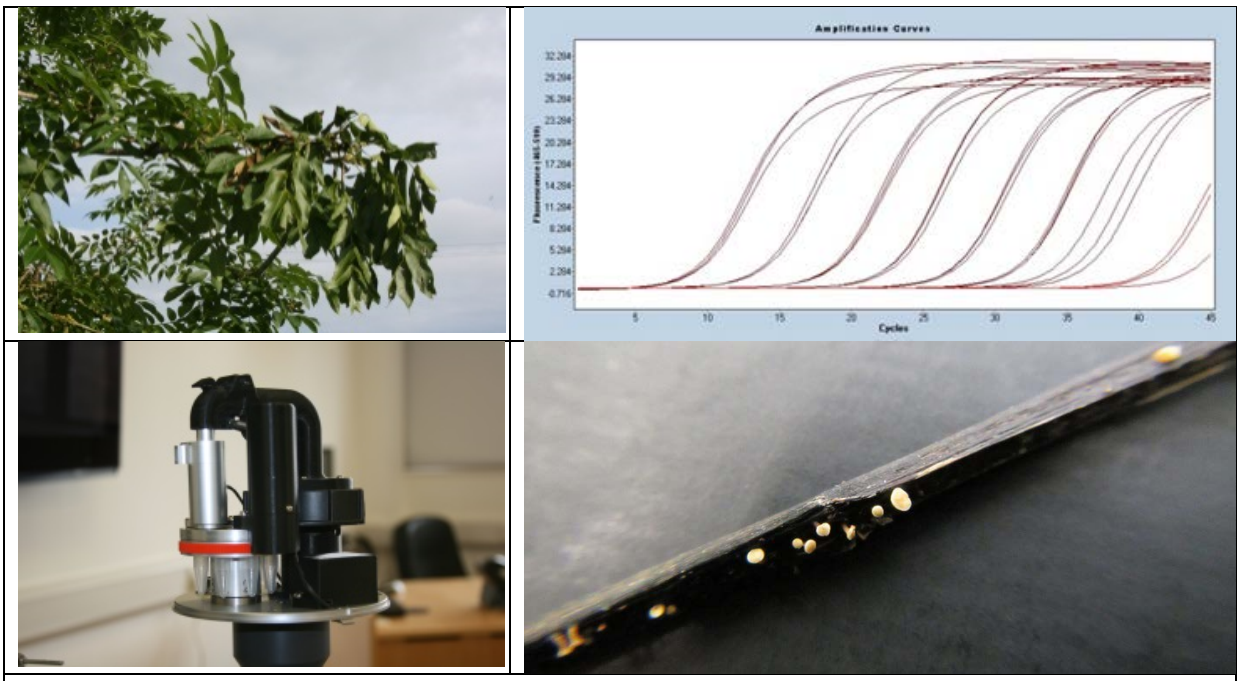

Fig 1. (a). An ash tree in Herefordshire, England with visible signs of ash-dieback(b) qPCR analysis on known material of *Hymenoscyphus fraxineus*. (c) Interior of the Burkard multi-vial cyclone. (d) Example of the fungus growing on the rachises from ash trees.

It has already been shown that it is possible to use genomic approaches to detect *Hymenoscyphus fraxineus* in both small and large quantities with high accuracy. It is based on real-time PCR (Fig 1b). The method is based on known samples and will be tested on airborne samples from 2016 and 2017. The detection in the field uses both the proven Seven-day recording volumetric spore trap from Burkard – the type of trap that forms the backbone of the European monitoring network - and a new generation of multi-vial cyclone samplers – also for seven day use. This sampler is optimised for genomic studies, for use in the field, and includes a new easy programmable unit for sampling into multiple Eppendorf tubes (Fig 1c). New approaches in ecological studies aiming at assessing the phenological behaviour of the fungus (Fig 1d) will be used in combination with very high resolution remote sensing. This will, in 2016/17, address the spatial and temporal behaviour of the fungus and how this is related to environmental variables. These experiments are very challenging as the fungus is an invasive species that requires quarantine. All experiments therefore follow strict security protocols to mitigate accidental spreading of the fungus from infected areas to healthy areas. Finally, the key findings will be implemented in a so-called next generation atmospheric model that is developed at University of Worcester. This model is globally applicable and fully integrates chemistry, biology and meteorology for use in both research and forecasting. If successful, then aerobiology will have contributed substantially towards sustainable management of the forest in UK and the mitigation of airborne pathogens.