Development of detection methods for quarantine plant pests for use by Plant Health Inspection Services Q-DETECT

In recent years, national plant protection organisations and inspection services have been put under strain, and not just from the usual plant pathogens and pests. With ever increasing global trade, the consignments that must be examined for infection are greater in number and size. Skilled inspectors are diminishing in number and there is not the same level of expexpertise coming through to replace them. Inevitably, time restraints for inspecting, approving and moving trade are tightening and so the risk of human error is increasing. The Q-DETECT project has been established with the aim of alleviating these stresses, thereby helping to develop long-term solutions for the identification of infections.

The problem of plant pathogens and pests slipping through undetected is a serious one. European Plant Health Policies currently list 275 organisms for quarantine (viruses, viroids, bacteria, fungi, insects, mites, and nematodes). If introduced, this could have serious economic and ecological consequences. The infiltration of western corn rootworm (*Diabrotica vergifera virgifera)* for example is estimated to cost Europe €147 million per annum, while invading insects and plant pathogens are estimated to cause $5 billion of damage annually to crops and forestry in the UK alone. Clearly, any project that can help to alleviate this problem is a sound investment; Q-DETECT has benefited from funding under the EU 7th Framework Programme. To enhance the global potential, the project operates through a number of partner organisations in Europe as well as countries as far afield as Peru and China.

The overall objective of Q-DETECT is to develop simple, user-friendly and robust methods for detecting and monitoring quarantine plant pests and diseases that threaten European crops and forestry. Due to the vast array of threats that can impact on these industries, this is not a simple task. There is no single method capable of spotting the various pests and infections, and there are several important demands for the suites of complimentary techniques that Q-DETECT aim to develop. Alongside ease of use, they must detect problems early with quick and reliable results. These methods must be validated under real-life conditions and then transferred effectively to end-users.

OBJECTIVES:

The Q-detect consortium will develop detection methods for quarantine plant pests and pathogens using innovative chemical, acoustic, remote imaging and pest trapping technology.

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Smelling, Seeing and Hearing pests

Q-DETECT aims to exploit the senses including sight, smell and sound, and also biochemical and pest trapping solutions to detect and identify plant pests. It is well documented that in response to infection, plants and fruits release bouquets of biologically active volatile organic compounds (VOC), acting as a telltale sign of inspection. Laser-based spectroscopic techniques and electronic nose methods will be developed to sniff out this contamination. Infected plants show a specific olfactory fingerprint that opens new perspectives for a VOC-based diagnosis of plant diseases. Remote imaging will take the form of infrared spectral classification. When viewed through the near infrared spectrum, thriving vegetation appears reflective because of the scattering that takes place between the spongy mesophyll cells of the plant. A diseased leaf is less reflective in this range, so diseased crops can be clearly identified.

Acoustic detection is essential when searching for wood-boring insects. These insects produce vibrations with any activity that involves movement, in particular biting or chewing, none of which can be detected unaided by the human. With improving technology, wood-boring insects can be heard above background noise. Q-DETECT aims to investigate alternatives to conventional methods by examining non-contact laser vibrometry, thus eliminating the effects of environmental conditions that adversely affect accelerometers and other contact transducers. The final aspect of detection that the researchers are working on is trapping. In biological invasions, trapping is of fundamental importance in the arrival and establishment phase of pests, as it provides information both about the invasive organism and its dynamics in relation to the environment.

Confirmation and Deployment

Most of the methods within Q-DETECT deal with early detection of a pest, however, it's important to combine the less targeted methods with the methods that allow the identification of the pest at the species level. Q-DETECT will develop simple methods based on DNA amplification that can be used by field inspectors. These techniques aim to amplify the nucleic acid of the pest in a species specific way, such that the inspector can quickly generate certainty over the exact species present.

Of course none of these methods are really useful unless they are deployed in the field, thus Q-DETECT will be working with EPPO to deliver training courses to Inspection Services and NPPOs to ensure that the tools get to the front line. Evidence for the potential benefits provided by the tools will be generated by modelling the impact they have on the inspection process.

The use of field testing is often viewed on the basis of 'how do these technologies fit into the way we work today?' whereas a more insightful question might be 'how will these technologies change the way we work tomorrow?'.

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SEVENTH FRAMEWORK PROGRAMME