



Original thinking... applied

PhD student proposal

Reference number: **PhD_Application_Fera2021**

Title: Assessing the plant health risk of newly discovered viruses from niche tuber crops

Supervisors:

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Dr Lisa Ward, RHS

Professor Neil Boonham, Newcastle University

PhD start date: January 2021

Closing date for applications: Monday 7th December 2020

Interview date: W/b Monday 14th December 2020

To apply please send a CV and covering letter stating the application reference number in the title of the email- to either Adrian Fox Adrian.Fox@fera.co.uk or Neil Boonham Neil.Boonham@newcastle.ac.uk

Background

Following the discovery of several novel or unusual viruses in the Andean tuber crop *Ullucus tuberosus* being grown and traded in the UK and Europe [1], further work was conducted to investigate a range of other niche crops including Yacon and Oca. These species are largely grown by the hobby grower as an exotic foodstuff and for interest, however there is an increasing interest in them as commercial crops. Similarly, further novel viruses were detected in these hosts. Of these, the greatest concern were two novel tymoviruses with a close genetic similarity to high-risk quarantine pathogens such as *Andean potato latent virus* and *Andean potato mottle mosaic virus*. Additionally, yacon purchased through internet trade was found to host a strain of *Potato yellowing virus*, potentially another high-risk quarantine pest if this strain is shown to infect potato[2]. *Potato yellowing virus* has also been recently reported to have been found in yacon grown in the UK prompting plant health action. Before assuming that any newly discovered viral agent is a potentially damaging pathogen work should be carried out to assess the biosecurity risk that virus poses to agriculture/horticulture [3] However, to risk assess such viruses, a lengthy process of biological characterisation is needed, such as that being carried out through Euphresco PRONC, however, that work is time consuming and alternative approaches need to be assessed.

Additionally, there is a need to give alternative sources of quality assured planting material and services that support its development, to enable growers to remove the need for sourcing material with poor provenance. As a result, the study will seek to engage with key stake holders to assess and pilot a clean plant scheme, based on virus tested propagation material.



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Aims and approaches

The aim of this PhD programme will be to investigate the risk that novel viruses found to be infecting these tuberous species present to UK agriculture and horticulture. In doing this the study will also investigate innovative approaches to risk assessment of novel viral pathogens using Andean tuber viruses as model pathogens for the study.

The study will encompass both biological characterisation, such as traditional host range, symptomology and transmission studies including contact, nematode and aphid transmission studies; sequencing approaches, such as using historic isolates or herbarium specimens for baselining presence, distribution; and bioinformatics approaches, such as short read archive database searches for *in silico* host range studies. Additionally, the study will also look to link in to the Euphresco project "PRONC" (Phytosanitary risks of novel crops) to look at the associated risk of inter-state trade in these species.

Benefits and outcomes

- Training: This programme will form the basis of training for a plant health policy literate plant pathologist/virologist with an additional grounding in pest risk analysis.
- Virus Characterisation and quantify presence and distribution: fully characterise novel virus in these tubers and to determine their frequency of infection
- Risk assessment: Using the techniques developed and tested through this study should allow for accelerated risk assessment of novel virus findings and can be further applied to other pathogen groups. Guidelines for rapid risk assessment of novel viral pathogens will be developed into a framework to guide future work.
- Assessment of a clean production system for niche crops: To help reduce the risk associated with the low-quality internet-sourced planting material, and in the absence of certification, stake holders will be engaged to develop a virus-tested quality assurance scheme for planting material.

References

1. Fox, A.; Fowkes, A.; Skelton, A.; Harju, V.; Buxton-Kirk, A.; Kelly, M.; Forde, S.; Pufal, H.; Conyers, C.; Ward, R. Using high-throughput sequencing in support of a plant health outbreak reveals novel viruses in *Ullucus tuberosus* (Basellaceae). *Plant Pathology* **2019**, *68*, 576-587.
2. Silvestre, R.; Fuentes, S.; Risco, R.; Berrocal, A.; Adams, I.; Fox, A.; Cuellar, W.J.; Kreuze, J. Characterization of distinct strains of an aphid-transmitted ilarvirus (fam. Bromoviridae) infecting different hosts from South America. *Virus Research* **2020**, 197944.
3. Hammond, J.; Adams, I.P.; Fowkes, A.R.; McGreig, S.; Botermans, M.; Oorspronk, J.J.A.v.; Westenberg, M.; Verbeek, M.; Dulleman, A.M.; Stijger, C.C.M.M., *et al.* Sequence analysis of 43-year old samples of *Plantago lanceolata* show that plantain virus X is synonymous with actinidia virus X and is widely distributed. *Plant Pathology* **2020** *In Press*.