

**PARALLEL SESSION 1: THURSDAY 29 OCTOBER - Q&A**

**Suzanne Sharrock (Chair), Adrian Fox, Sara Redstone**

Identity	Content
Sara Redstone	Excellent presentation Adrian. Screening seed for known pathogens is a recognised approach, especially when dealing with seed of crop species. How might we screen for unknown organisms - especially where we are collecting from the wild - and how do we manage any information this produces?
Adrian Fox	<p>Q. Screening seed for known pathogens is a recognised approach, especially when dealing with seed of crop species. How might we screen for unknown organisms - especially where we are collecting from the wild - and how do we manage any information this produces?</p> <p>A. Using high throughput sequencing approaches we can now effectively screen plant material for all known pathogens, and the methods for doing this are becoming cheaper to access and increasingly amenable to decentralisation. So for example a screening programme could be initiated to bulk screen seeds and to at least give an indication of the presence of viral pathogens, which when combined with effective in-field hygiene procedures would be a step forward in ensuring collected seed was as clean as possible.</p> <p>The second part of the question is how we manage the information that would arise from this type of testing. This 'non-target' sequencing approach will detect the presence of known and novel pathogens and these may be benign. Currently the assessment of risk from these detections would be carried out on a case by case basis.</p>
Sara Redstone	<p>Do we know if Defra have plans to tighten up on selling of seeds on popular internet platforms?</p> <p>Internet trade in both live plants, plant products and seeds is an area of concern - and has been for some time - for Defra and the various organisations working to deliver biosecurity and plant health policy across the UK. It is recognised as a pathway which poses serious risks to our biosecurity, health and wellbeing. Internet trade has also been shown to contribute to illegal wildlife trade in plants and animals and can be a route by which other invasive species enter the UK eg ants.</p>
Adrian Fox	<p>Q. Is it possible for the leaf virus in species Cannas can be transferred via seed</p> <p>A. Of the main canna affecting viruses, a few of them are potyviruses which tend to be insect transmitted and not transmissible by seed, though specific information is not available. The other virus, canna yellow mottle virus is a badnavirus and these are known to be seed transmitted in other virus/host combinations, however, in canna propagation the use of rhizomes would prevent the highest risk due to them being vegetative.</p>
Sara Redstone	<p>Q. would you say then to not buy any wild plant material from the internet?</p> <p>A. Absolutely! Apart from biosecurity risks you also run the risk of breaching national laws (eg CBD, ABS, CITES, plant health, etc) in both the source country or the UK. Plant material may have been illegally harvested which may contribute to the reduction or even extinction of plant populations in the wild. There's also evidence to show that illegal wildlife trade supports other forms of criminality so</p>

	<p>please source material with care. Wild collected material advertised for sale online may seem cheap but there may be costs further down the line that you haven't considered.</p>
Adrian Fox	<p>Q. would you say then to not buy any wild plant material from the internet?</p> <p>A. Please don't! Wild collected plant material being shipped around the world may breach multiple international conventions (See Sar's response). Please only buy from reputable sources, such as Defra certified seed producers.</p>
Adrian Fox	<p>Q. Generally speaking, are there differences in disease expression between viruses transmitted from true seed vs when they're horizontally acquired?</p> <p>A. Symptomology tends to be related to virus/host combination, though there are cases where early infections can give a 'flush' of symptoms which the plant then tolerates as it grows. There tends to be a greater difference in symptomology between non-cultivate hosts and crop hosts. My suspicion is that this is the origin of the belief that 'wild hosts are clean'.</p>
Sara Redstone	<p>Q. Do you think seed surface sterilisation techniques, like soaking seeds in a weak bleach solution, have a role to play in reducing bacterial and fungal pathogen risk when growing plants? But unfortunately this wouldn't help with viruses.</p> <p>A. sterilisation can be useful for external contamination. personally i prefer to use products like hydrogen peroxide as this leaves no residues on the seed which might be phytotoxic. peroxide also has the advantage of helping trigger the biochemical processes of germination - often resulting in higher levels and more uniform germination</p>
Adrian Fox	<p>Q. Do you think seed surface sterilisation techniques, like soaking seeds in a weak bleach solution, have a role to play in reducing bacterial and fungal pathogen risk when growing plants? But unfortunately this wouldn't help with viruses.</p> <p>A.This could be helpful for some viruses, and is used in industry for commercial clean-up of seeds - so yes. Though if you are using this for control of a specific pathogem rather than as part of a general disinfection protocols you would need to check the plant protection product regulations.</p>
Sara Redstone	<p>Q. Are there any plans to do some more surveying of BG&amp;A seed collections and submissions.</p> <p>A. Not currently but I hope we may be able to address this concern in the near future. At the moment we are still working on understanding and adapting to the recent changes to plant health legislation to ensure we are both compliant AND safe. A phyto isn't a guarantee seed is free of pests and diseases so it is best to be cautious. Currently, we send seed or plant material to FERA for testing as and when required eg when we are sharing with users outside the UK and lab tests are required as part of the export phytosanitary checks. I'm in the process of looking at options for routine screening that might be of benefit to other germplasm collections too. Whilst it seems a very simple this could have serious practical and resource implications, so if a system can be put in place we are likely to prioritise high risk taxa or material from high risk environments initially.</p>
	<p>Q, Can viruses carried on tubers of solanum transfer into ornamental solanum species or genera</p>

Adrian Fox	<p>A. There are multiple viruses which can infect the Solanaceae (e.g. over 120 viruses have been reported as able to infect tomato). In some cases these will be restricted to a single host, and some others have a restricted host range within the genus. However, there are some which can transfer between hosts.</p> <p>If growing certified seed potatoes these have been produced within an rigorous inspection regime and will pose a negligible plant health risk, however, there are some viruses and viroids which are known to infect solanaceous ornamentals, often asymptotically, which may transfer to tomato, pepper and potato.</p>
Sara Redstone	<p>Q. How should seed banks manage the risk of viruses, while allowing them to conserve seeds?</p> <p>A. It's important we continue to work to collect and bank seed to conserve genetic information. It's also important that we understand what organisms are associated with the seed – internally or externally – and any risks associated with them. Some organisms – including viruses - may even be beneficial to the seed or any resulting plants grown from it eg conferring improved drought tolerance, for example. When we share seeds we should always make it clear – eg via our material supply agreement - that the recipient has a duty to monitor for diseases (hopefully screening of seed for invertebrates will already have been undertaken, post-harvest). Ideally, in the future, all seed and germplasm banks will have the capability to screen material and analyse and manage the risks identified – with external, expert input if necessary. High risk hosts eg Solanaceae, poaceae should be a priority for any routine screening but I appreciate that setting up and operating such a system will have an impact on budgets and resources so my personal view is that, as things currently stand, we urgently need to focus on capturing as much genetic diversity as we can – through seedbanks, tissue culture, cryopreservation and as live plants. Alongside this we need to work collaboratively to identify practical, affordable methods by which we can screen collections and identify and manage biosecurity risks in the future.</p>
Adrian Fox	<p>Q. How should seed banks manage the risk of viruses, while allowing them to conserve seeds?</p> <p>A. Taking a process approach with prophylactic measures – assume something is a risk until proven otherwise! E.g. using good biosecurity hygiene practices on collection. Additionally, including some type of pathogen screening in protocols would be a useful addition to protocols.</p>
Adrian Fox	<p>Q. Other than new ToBFRV testing requirements are any other seed species tested for viruses?</p> <p>A. There is routine testing of a proportion of solanaceous seed and other listed genera, and these are tested for the listed viruses, so on tomato there is testing for pepino mosaic virus and also viroids as well as ToBFRV. (Other than new ToBFRV testing requirements are any other seed species tested for viruses? )</p>
Adrian Fox	<p>Q. If seeds are found to be infected, what is a safe way to dispose of them if you do not have access to an autoclave?</p>

	<p>A.This depends upon what is found... If this is a plant health regulated pathogen this should be reported to the appropriate plant health authorities (APHA/Defra in England and Wales, SASA in Scotland).</p>
Sara Redstone	<p>Q. If seeds are found to be infected, what is a safe way to dispose of them if you do not have access to an autoclave?</p> <p>A. From 1<sup>st</sup> January 2021 all seed and most other forms of plant material (other than a few types of tropical fruits ) - NOT just material for planting - entering the UK will require either a phytosanitary certificate or letter of authority ( and a scientific licence and quarantine) to legally import it. Highest risk regulated material needs to be declared before it arrives in the UK and all notifiable material should be inspected on arrival here.</p> <p>As Adrian says, if you suspect a notifiable pest or pathogen you should secure the material - an airtight container will do – or a jam jar of alcohol (vodka has been used in the past!). Keep it safely and then notify the relevant authorities as soon as possible. In England and Wales this is likely to be APHA. Incinerate or perhaps place in a container (with a vented lid) with a little water in a microwave and BOIL. If there’s a lot of seed then a pressure cooker (a domestic autoclave) would do the job. The resulting material can be disposed of to your normal waste stream.</p>
Sara Redstone	<p>Q. ‘Brushing scams’ have made the news, where seeds that haven’t been ordered are being sent from Asia to people around the world. Obviously, people should not sow these seeds. What kind of biosecurity risk do they pose?</p> <p>A. The risk they pose will depend on what taxa they are, their origins and how they were produced and how they’ve been processed. The seeds are entering the UK illegally and haven’t been subject to any of the tests or certification they require to enter the UK legally. As many appear to be seed of vegetable crops then there is the potential of introducing new diseases or pests that don’t currently occur in the UK or Europe and these could have a devastating effect on gardens, farms and the wider environment. There’s also the risk of introducing invasive plant species too. Please report any unsolicited gifts of seed and send them to the relevant authority (see gov.uk for info).</p>
Sara Redstone	<p>Q. Is there any training available for horticulturists specifically on biosecurity issues?</p> <p>A. Yes. From a variety of sources – some is more theoretical than practical. At Kew I provide education and training for staff, apprentices, Diploma and MSc students on biosecurity, plant health legislation, quarantine and related issues (including legal compliance/ Nagoya, CITES, etc). Where appropriate we undertake practical exercises looking at the different processes and documentation required for safe and legal import, export and sharing of material. I also do a 30 minute induction session – largely focused on biosecurity - as part of our compulsory 3 day induction for all new staff, students and volunteers - because biosecurity best practice is something everyone should be aware of and engaged in.</p> <p>Apart from this, checkout resources on the PlantNetwork website and keep an eye out for future workshops and seminars. Many other organisations in the UK like the Arboricultural Association and BALI have produced biosecurity</p>

	<p>guidance for members and hold regular talks on relevant topics. The Chartered Institute of Horticulture is looking at developing CPD for members on many themes including biosecurity. Electronic awareness training is available via bodies like the GB Non-Native Species Secretariat and Forestry Commission. If you want to go to the next level then Harper Adams have worked with Defra to develop postgraduate qualifications in plant health and biosecurity.</p>
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