



Agriculture & Horticulture
DEVELOPMENT BOARD



New Project

FV 382a

Carrot: investigating a link between internal browning and the viral diseases PYFV and CMD

Project Number: FV 382a

Project Title: Carrot: investigating a link between internal browning and the viral diseases PYFV and CMD

Project Leader: Adrian Fox

Contractor: The Food and Environment Research Agency (Fera)

Industry Representative: Howard Hinds, Howard Hinds Consultancy

Start Date: 1st April 2012

End Date: 31st March 2013

Project Cost: £ 51,360

SUBJECT TO CONTRACT

Project Summary:

- a. Diagnostic development: Validate a suite of real-time PCR assays: Real-time PCR assays have been designed to cover the suite of viruses associated with UK carrot crops, (CtRLV, CtRLVaRNA, CMoV, PYFV and AYV). These would be validated against nucleic acid extracts from the 2010 field survey (FV382), and further validated against samples from a field study as part of this project. (In turn, assays developed through HDC funding would be offered as a service to HDC levy payers at a discounted commercial rate.)
- b. Studies on incidence of CMD viruses in field weeds and carrot crops: Survey common weed species, focussing carrots with foliar symptoms and on umbelliferous weeds in and around carrot fields and test them for the presence of all the common carrot viruses. Focus would be given to a small number of fields where internal browning and carrot viruses are strongly associated (i.e. those where high levels of necrosis have been previously observed). Sampling would take place on a range of dates at each site to cover temporal as well as spatial distribution of virus hosts. Virus positives would be sequenced and their phylogeny would be investigated to provide data on the sources of viruses found affecting carrot crops. (Approx. 100 samples taken from fields identified as having poor virus health covering growing carrots and umbelliferous weeds.)
- c. Aetiology of internal browning:
- (i) Compile a dataset on the viruses present in carrots with necrotic root symptoms and carrots showing foliar symptoms in the field. To make the interpretation of this analysis statistically robust, an estimate of incidence of both virus and necrosis will also be required. Equal numbers of necrotic and non-necrotic 'control' carrots would then be tested and a

statistical model applied to test the link between symptom and causal agent. (Minimum of 80 samples tested; half necrotic / half 'control' samples).

(ii) A number of affected and unaffected carrots would be analysed using next-generation sequencing to ascertain the presence of other non-target viruses/pathogens which may be a contributing cause of internal necrosis. (24 samples to include individuals which are 'Healthy'(4); Necrotic virus positive(10); Necrotic virus negative(10)).

Aims & Objectives:

(i) Project aim(s):

The project aims to build upon previous work (FV228 and FV382) to identify a link between carrot virus infection and internal necrosis in carrot roots. In addition to this aim further work will be conducted to identify possible sources of carrot viruses from the Carrot Motley Dwarf complex in the environment.

(ii) Project objective(s):

a) Diagnostic development: Validate real-time RT-PCR assays to detect the CMD complex of viruses and PYFV to enable cost effective work on epidemiology of the virus complexes.

b) Epidemiological studies on incidence of carrot viruses in field weeds and carrot crops: In combination with data on PYFV from FV228, further data on alternate host reservoirs of CMD would give a measure of the importance of these virus sources in the epidemiology of carrot viruses. To enable focus on internal symptoms, a substantial number of samples exhibiting internal browning would be taken from packing and processing houses.

c) Investigating the viral causes of internal browning: build a dataset on the presence of symptoms and the viruses associated with necrotic root symptoms to gain a better understanding of the relationship between virus infection and symptom development. In addition, an investigation into affected and unaffected carrot genomics using next-generation sequencing would look for any other, as yet unidentified, viruses.

Benefits to industry

a) Unlike external root symptoms traditionally associated with PYFV (e.g. cigar shaped roots), internal necrosis cannot easily be graded out leading to rejection of consignments at processors and pack-houses.

(i) A better understanding of the relationship between virus infection and internal browning should lead to a reduced incidence of these symptoms through improved management strategies.

(ii) This in turn should lead to reduced waste from the industry both through reducing numbers of carrots rejected on the grading line and numbers of crops rejected at processors and pack houses.

b) Advanced diagnostic assays have been designed and, once validated, can be offered as a diagnostic service to UK carrot growers.

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