



Agriculture & Horticulture
DEVELOPMENT BOARD



Grower Summary

SF 135

Genetics of resistance to
Verticillium wilt in strawberry

Final 2014

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Further information

If you would like a copy of this report, please email the HDC office (hdc@hdc.ahdb.org.uk), alternatively contact the HDC at the address below.

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GROWER SUMMARY

Headline

DNA markers for resistance to Verticillium wilt found to be present in a wide range of cultivars and other accessions available to UK strawberry breeders

Background and expected deliverables

Genes responsible for resistance to Verticillium wilt had been identified in an earlier project funded by the Biotechnology and Biological Sciences Research Council (BBSRC). The primary aim of this project was to validate markers for these resistance genes by looking for their presence or absence in a wide range of unrelated strawberry cultivars and correlating this with the field resistance of those cultivars to *Verticillium dahliae*. A second aim was to investigate if there was a distinction between resistance and tolerance to *V. dahliae* and if these were under separate genetic control. Once validated, the resistance gene markers will enable plant breeders to undertake marker-assisted breeding in strawberry, which will benefit the industry through the development of cultivars with strong and durable resistance to Verticillium wilt.

Summary of the project and main conclusions

In an earlier project, genes associated with resistance to Verticillium wilt had been identified in a progeny of 188 seedlings from the cross Redgauntlet x Hapil. We tested for the presence of molecular markers for five of these genes in 46 cultivars and breeding lines that had all previously been characterised for resistance to wilt on multiple occasions, using a highly infested field plot maintained at EMR. The majority of these lines were either unrelated or only distantly related to Redgauntlet, which was the source of resistance in the original cross. All of the markers were found to be more common among the resistant lines than the susceptibles in the 46 lines that formed the validation set but no single marker could be considered to be an accurate predictor of resistance when considered in isolation.

Following the validation of the markers, a further 128 strawberry lines were tested for presence of the resistance markers. These lines included modern cultivars, old cultivars and breeding lines from the EMR collection, and selections and parental lines being evaluated by the EMR Strawberry Breeding Club. In this wider collection the frequency of the alleles was variable and two, HRGP₂₁₃ and RVd4, were found to be rare in modern cultivars but more

common in the old cultivars contained in the EMR collection. Cultivars and lines with the strongest field resistance to wilt typically had two or more different resistance markers present. The markers have been used in planning the 2013 and 2014 crossing programmes for the EMR Strawberry Breeding Club. Crosses were designed that will increase the probability of resistant individuals being present in the seedling populations that will be evaluated in 2014 and 2015.

A glasshouse experiment comparing two isolates of *Verticillium* wilt showed a large difference in their pathogenicity. Plants inoculated with the more pathogenic isolate were used to quantify the amount of pathogen DNA in petioles from a range of strawberry lines including resistant, susceptible and intermediate types. *Verticillium dahliae* DNA was found to be present in all lines except one, suggesting that it is not possible to distinguish between resistance and tolerance to wilt but that it is a straightforward quantitative trait where multiple genes have a cumulative effect on the level of resistance expressed.

Financial benefits

There will be downstream benefits from this project as the resistance markers will enable the EMR Strawberry Breeding Club and other UK breeders to develop future cultivars with strong and durable resistance to *Verticillium* wilt. These cultivars will benefit growers who wish to grow in the soil rather than substrate and will reduce the need for soil fumigation. Soil production is a cheaper system than substrate growing on table tops since the capital investment is not required for the table-top system and there is no requirement to purchase substrate. Harvesting costs are lower on table tops but this does not fully compensate for the increased expenditure in other areas.

Action points for growers

There are no immediate action points for growers but they should be aware of the opportunities offered by future cultivars with strong resistance to *Verticillium* wilt.