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Biodiversity in *Rubus* polyphenol content and composition

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Introduction

There is an accruing body of evidence to support the health benefits of soft fruit consumption. Although some of these are derived from the constituent vitamins, fibre and mineral intakes the more novel and delicate influence appear to rest with the polyphenol classes and individual components. Model and *in vivo* studies by our group (1-4) have shown these components to impact beneficial on cancer, cardiovascular disease and obesity. Consequently polyphenols have become traits to be targeted for in breeding programmes and subsequently the search is on for germplasm with diverse polyphenol content and composition. As part of an ongoing study into *Rubus* diversity we have taken an LC-MS metabolomic approach and mined an extensive germplasm collection hosted between the collaborators

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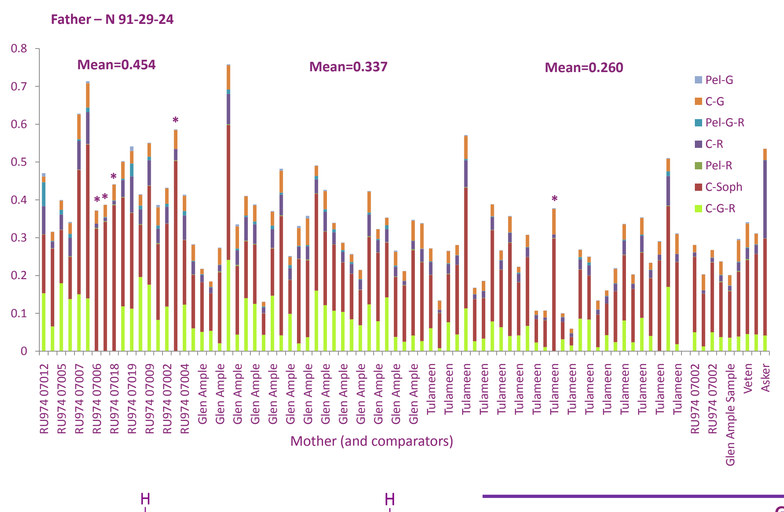
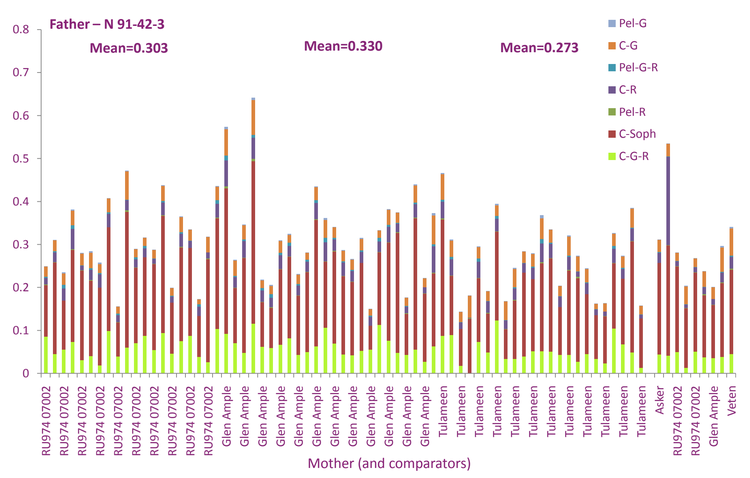
Methods

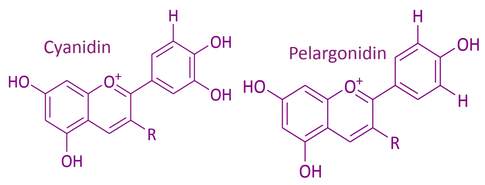
Specific raspberry crosses were constructed from a mix of advanced breeding lines and well known industry leading varieties by Graminor. Father - N 91-29-24 and N 91-42-3; Mother – RU974 07002, Glen Ample and Tulameen. The fruit (including the mother parents and other comparators) were harvest at maturity, frozen and shipped to the JHI for analysis. Optimised polyphenol extracts were prepared by extracting the thawed fruit with 50% acetonitrile/1% formic acid on a w/w basis. The extracts were concentrated, filtered and analysed by Orbitrap LC-FT-MS. Data were processed using on board Xcalibur™ software and quantified using a cocktail of different polyphenol standards.

Results

Anthocyanin levels (μg/ml) in raspberry crosses

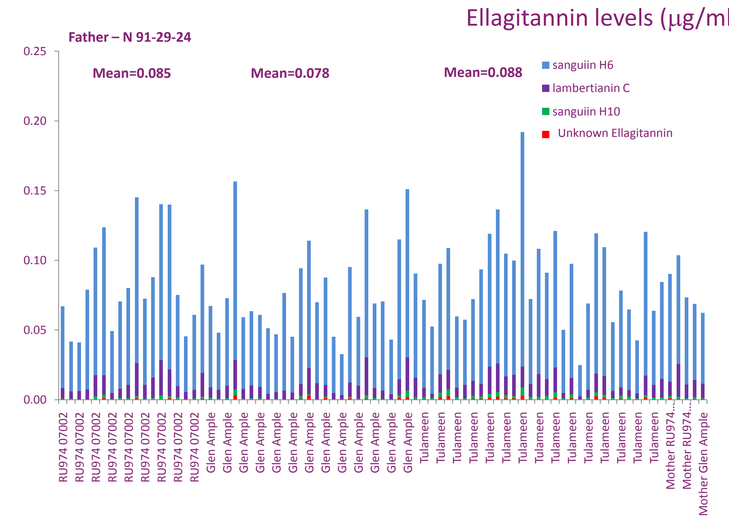


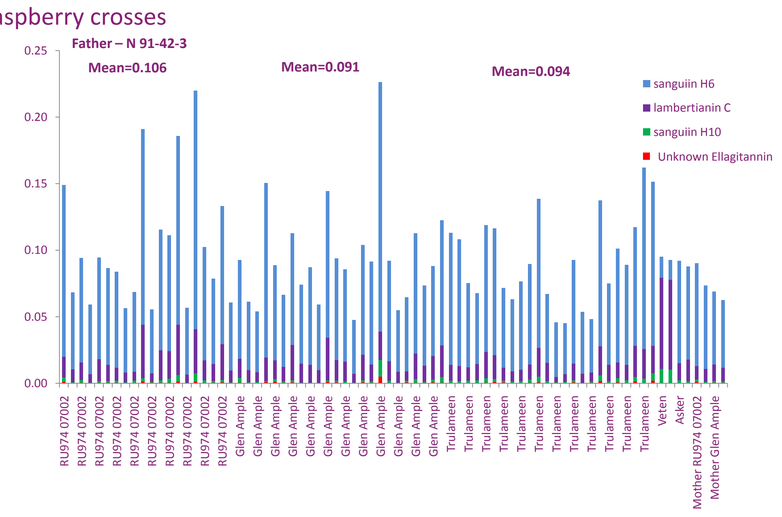


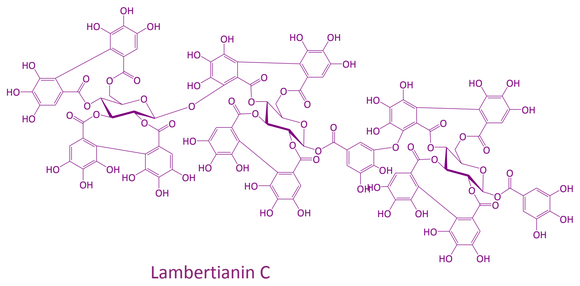


	Glucose G	Rutinose R	Sophorose Soph	Glucose-Rutinose G-R
Cyanidin (C)	C-G	C-R	C-Soph	C-G-R
Pelargonidin (Pel)	Pel-G	Pel-R	-	Pel-G-R

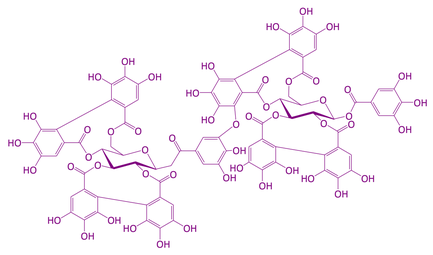
Ellagitannin levels (μg/ml) in raspberry crosses



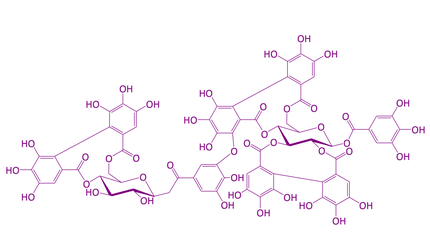




Lambertianin C



Sanguiin H6



Sanguiin H10

Conclusions

- Even in this limited set of crosses polyphenol diversity is significant.
- C-Soph, C-R and C-G-R are the dominant anthocyanins but their relative proportions vary considerably.
- N 91-29-24 (M) x RU974 07002 (F) yielded the best mean anthocyanin contents (0.454 μg/ml). However some of the progeny (*) were completely deficient in C-G-R.
- Sanguiin H6 and Lambertianin C were the dominant ellagitannins and the relative proportions of these varied significantly both within and across the crosses.
- All crosses with N91-42-3 as the father exhibited greater comparative (to N 91-29-24) mean ellagitannin levels.
- An as yet uncharacterized and minor ellagitannin was quantified (ellagic acid equivalents).
- All individual polyphenols were characterized and quantified for each line using a metabolomic approach . This yielded a significant reduction resource and man-time requirements and delivered highly detailed data that can very quickly be translated through to breeding programmes.