

Metabolite profiling of cloudberry (*Rubus chamaemorus* L.)



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Espoo, Finland

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Cloudberries (*Rubus chamaemorus*)



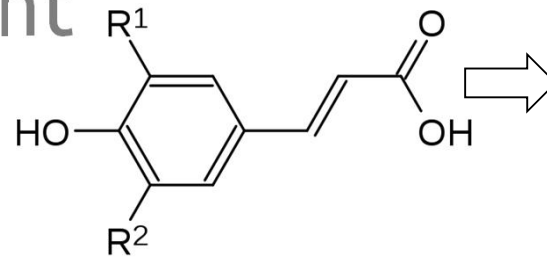
Annual parts



Perennial parts

Cloudberry content

- Vitamin C
- Micro - and micronutrients; Fe, Cu, Mn, Zn, Mg, K, Ca and P
- **Polyphenols**



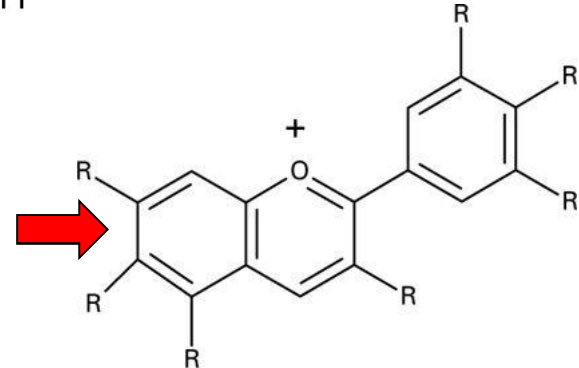
Hydrozycinnamic acids:

p-Coumaric acid R=H
 Caffeic acid R=OH
 Ferullic acid R=CH₃



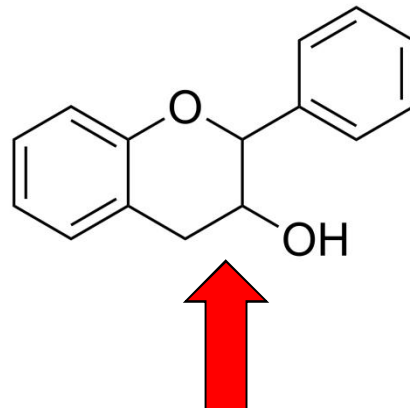
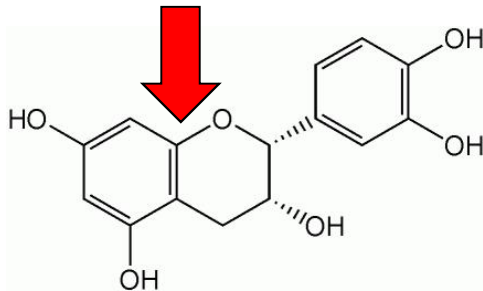
Anthocyanins

Cyanidin R=OH
 Pelargonidin R=H



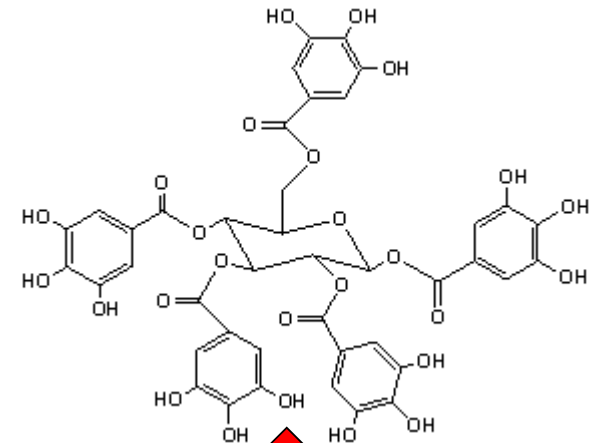
Flavonols

Quercetin R=OH
 Kaempferol R=H
 Isorhamnetin R=OCH₂



Flavan-3-ols and proanthocyanidins

Catechin, Epicatechin, Afzelecin, Epiafzelechin

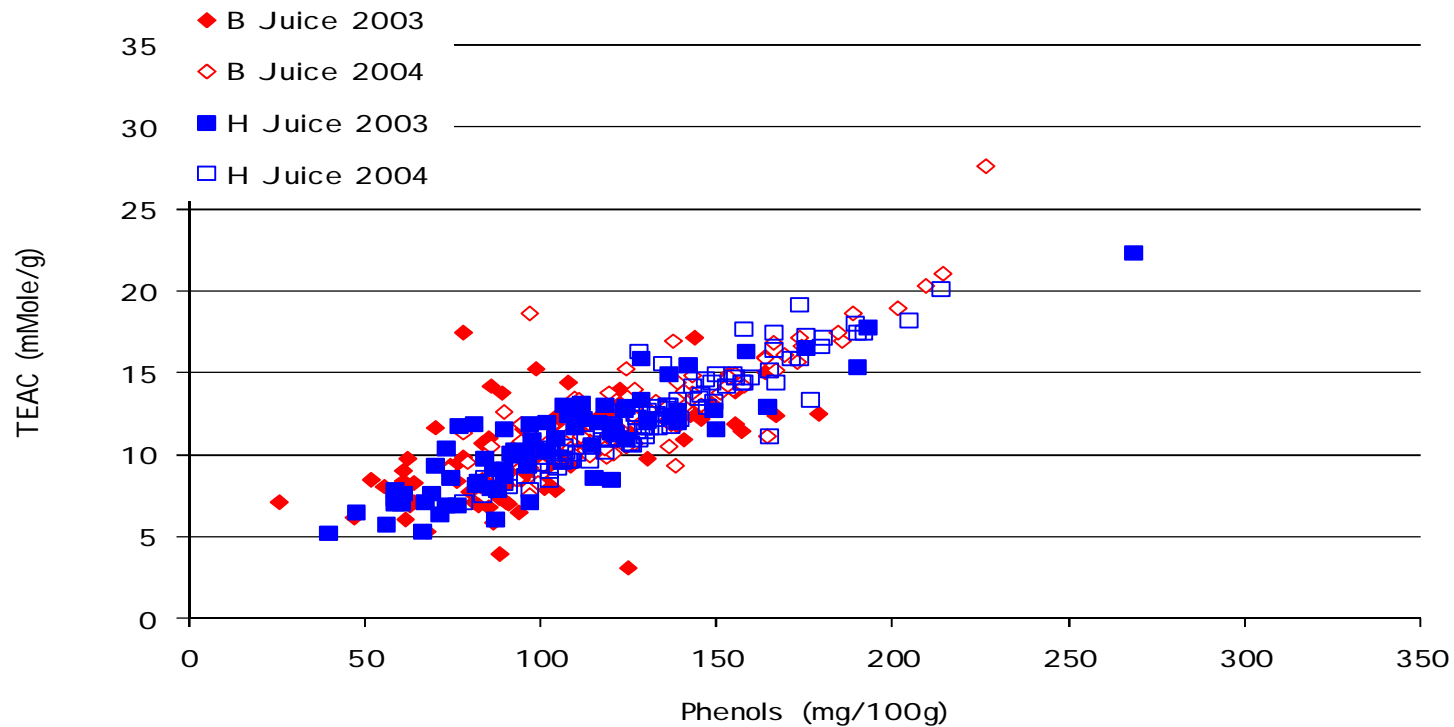


Ellagitannin (galloyl-bis-HHDP-glucose)

Levels of antioxidants related to levels of polyphenols

Stewart et al. 2007 Metabolomic approach to identify bioactive compounds in berries: Advances toward fruit nutritional enhancement Mol.Nutr.Food Res

Juice Antioxidant capacity v Phenol content: Site and year variation



Controlled experiment in phytotrone

Martinussen et al. 2010 J Berry Research



Plant material

- 'Fjellgull', pollinated with 'Apollen'
- 'Fjellgull', pollinated with 'Nyby'
- 'Nyby', self pollinated



Temperature

9, 12, 15 and 18°C

24-t photoperiod, PAR ca 120 $\mu\text{mol m}^{-2} \text{s}^{-1}$

Autumn

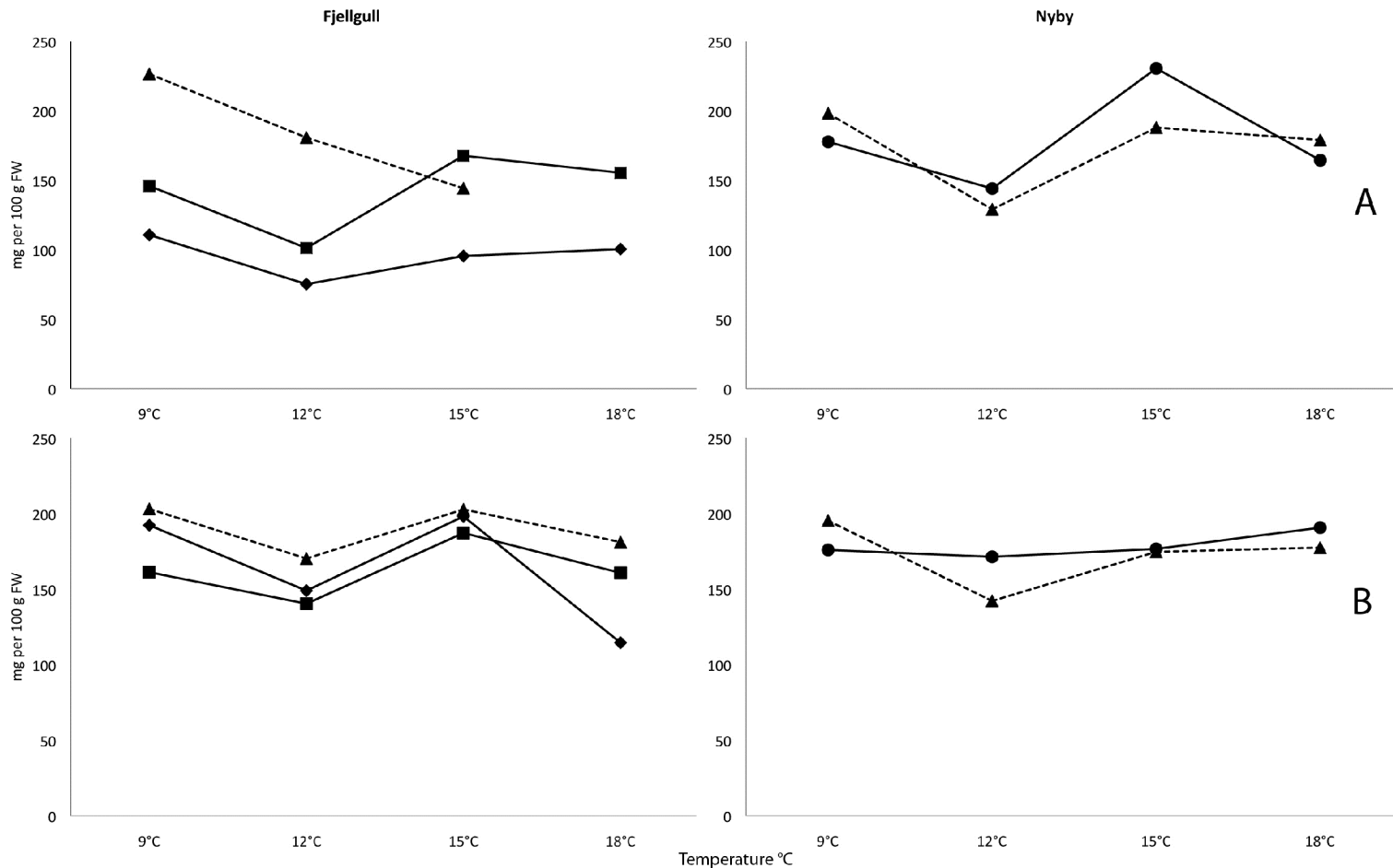
Maturity

'Fjellgull'; female clone - RED



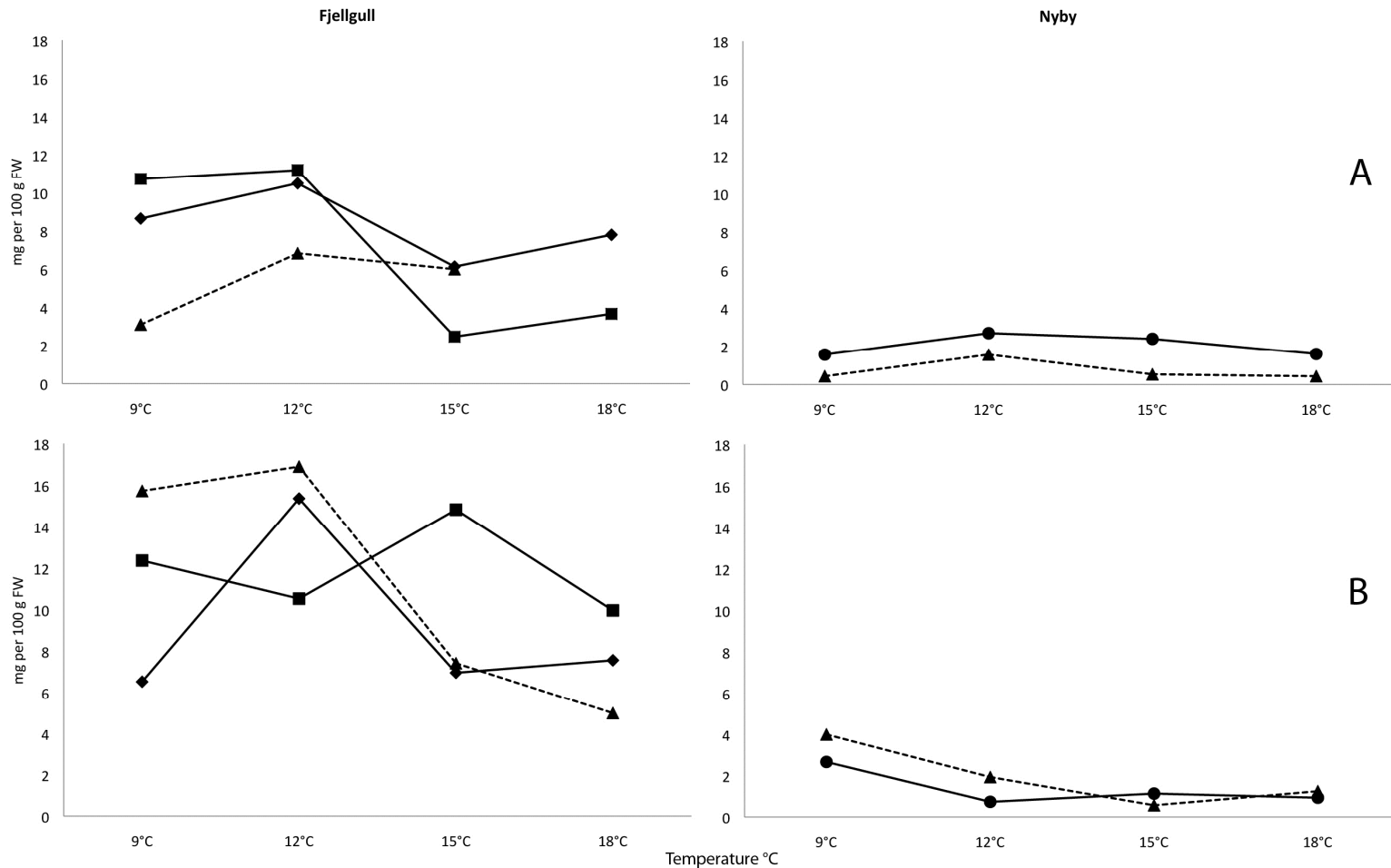
'Nyby', hermaphrodite - YELLOW

Totale phenols, mg 100 g⁻¹



(◆) Fjellgull * Apollen (●) Nyby selvpollinert (■) Fjellgull * Nyby (▲) GA₃.

Total anthocyanins, mg 100 g⁻¹



(◆) Fjellgull * Apollen (●) Nyby selvpollinert (■) Fjellgull * Nyby (▲) GA₃.



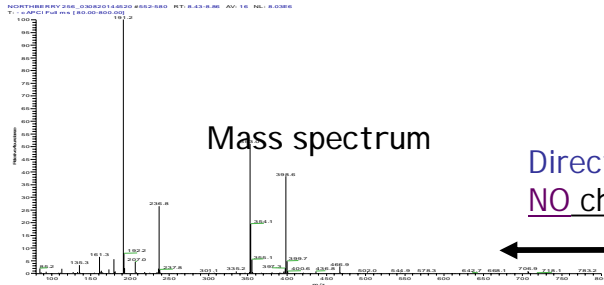
Cloudberry clones

Targeted analysis

Yield, flavour, aroma taste, texture, disease resistance, bioactivities, nutritional relevance, antioxidant capacity, polyphenol content, ascorbate, anthocyanins

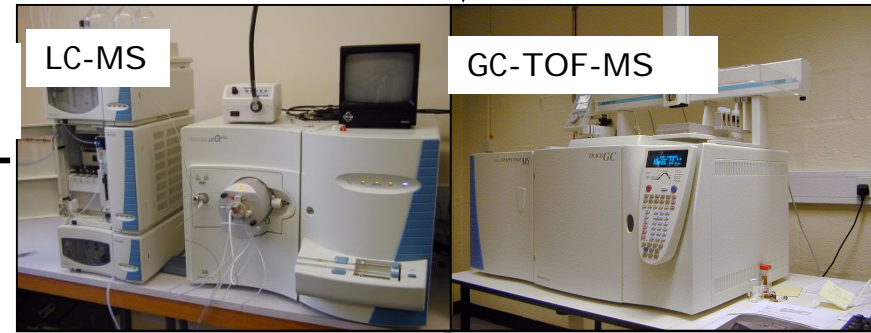


Untargeted analysis: Hi-through-put metabolic profiling



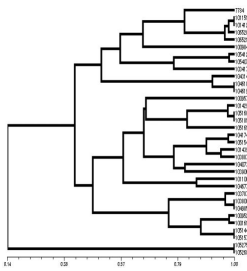
Mass spectrum

Direct Infusion MS
NO chromatography

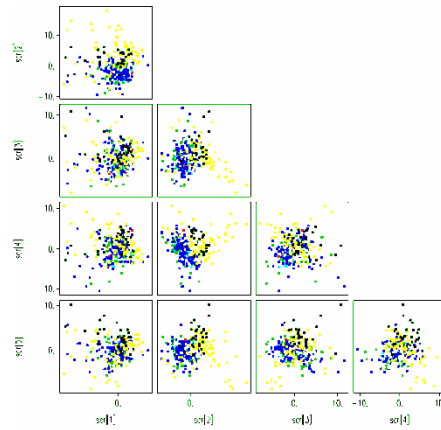


LC-MS

GC-TOF-MS

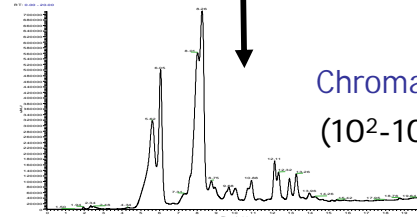
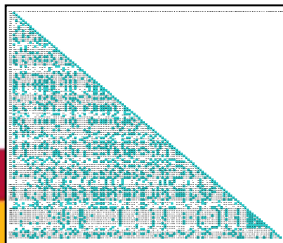


Hierarchical cluster analysis:
Measure of (phytochemical) biodiversity - link to genetic map

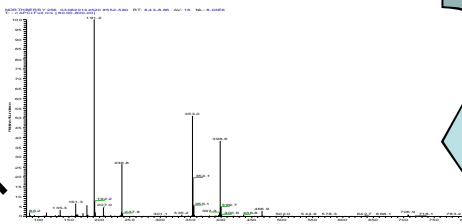


Correlation Network:
Interrelate metabolite changes. Pathway cross talk

Compounds 1-500

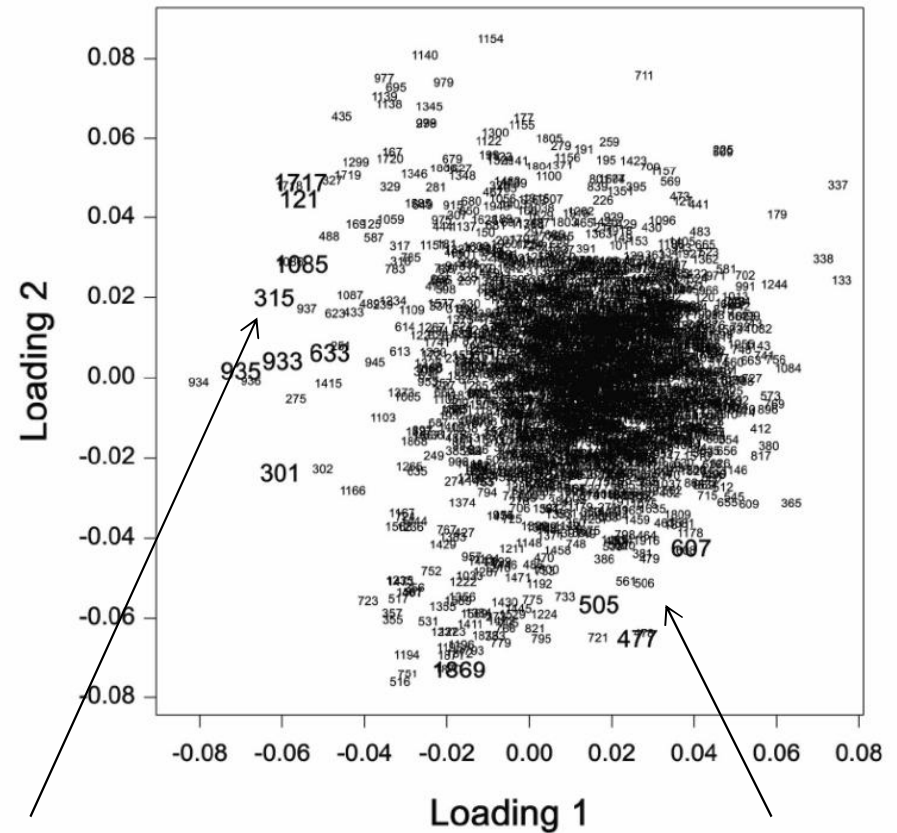
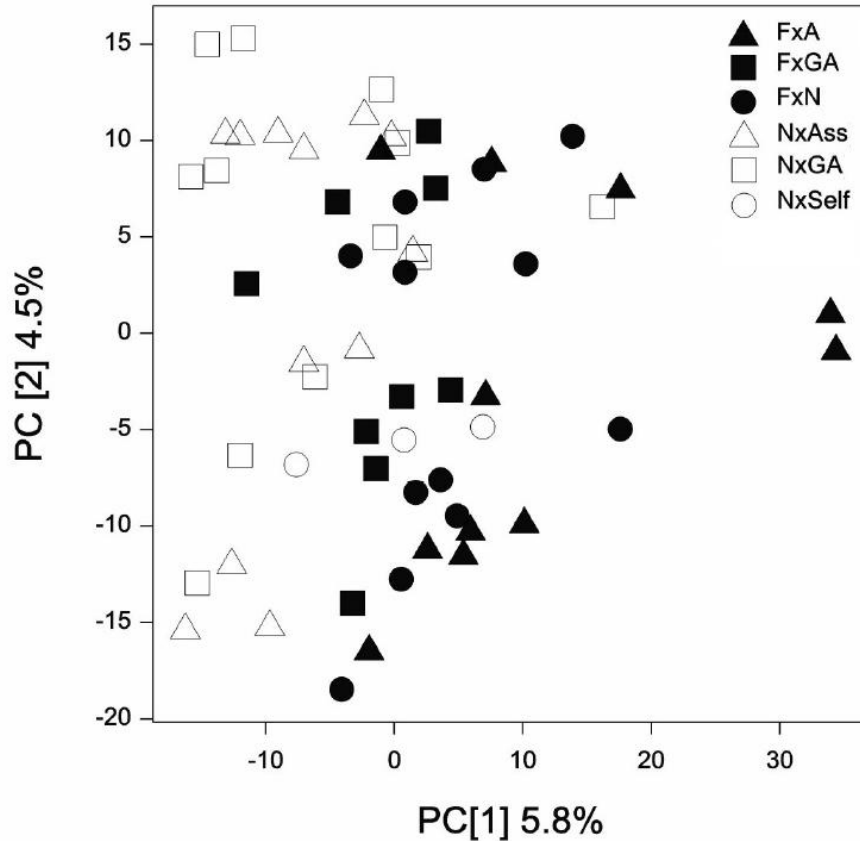


Chromatogram
(10²-10³ compounds)



ACMS- based on female clone

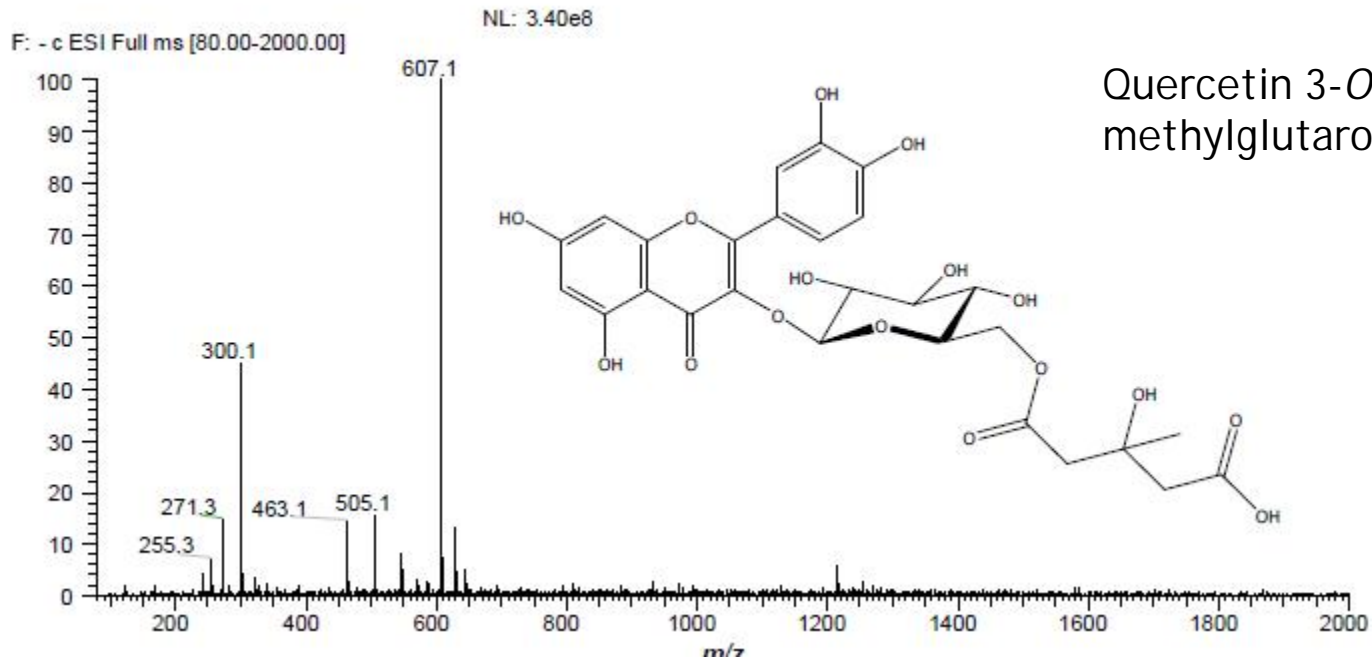
McDougall et al. 2011 J. Agric and Food Chem



Ellagitannins

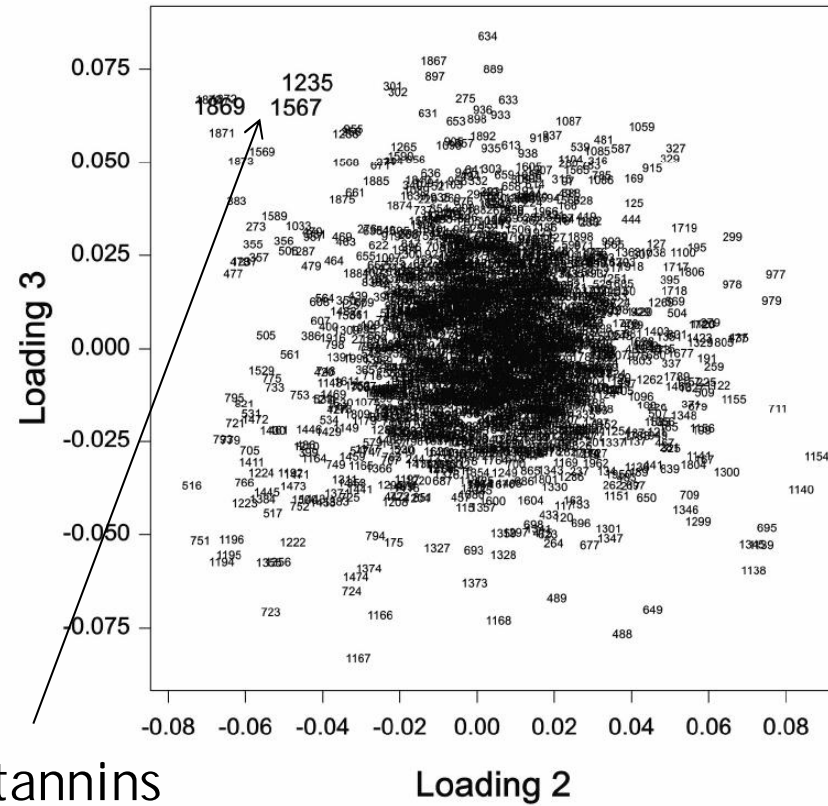
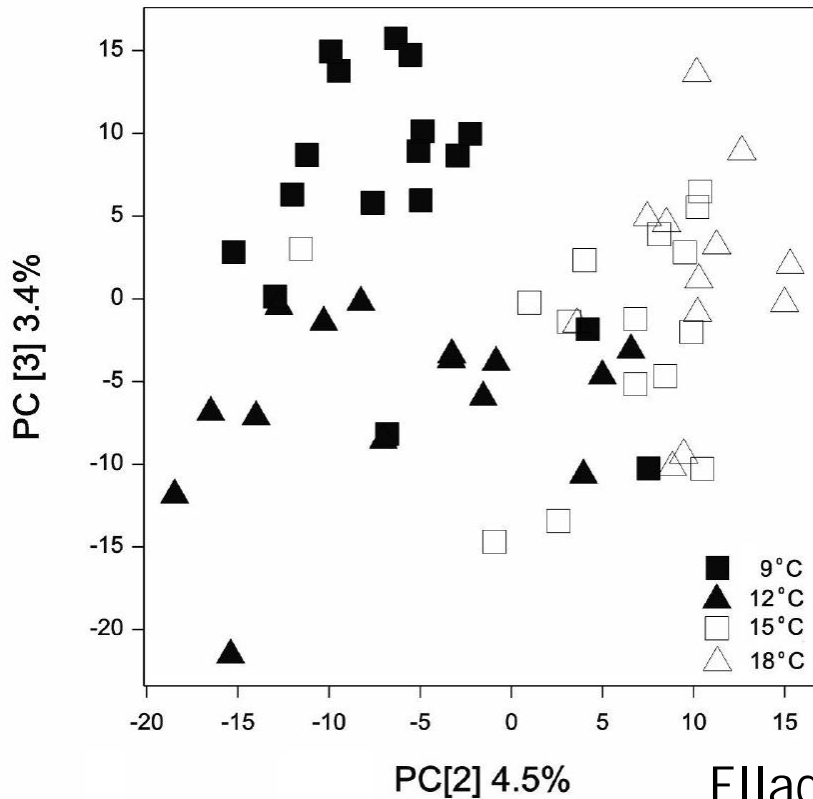
Quercitin derivatives

Mass spectral properties of unknown compound with $m/z = 607$



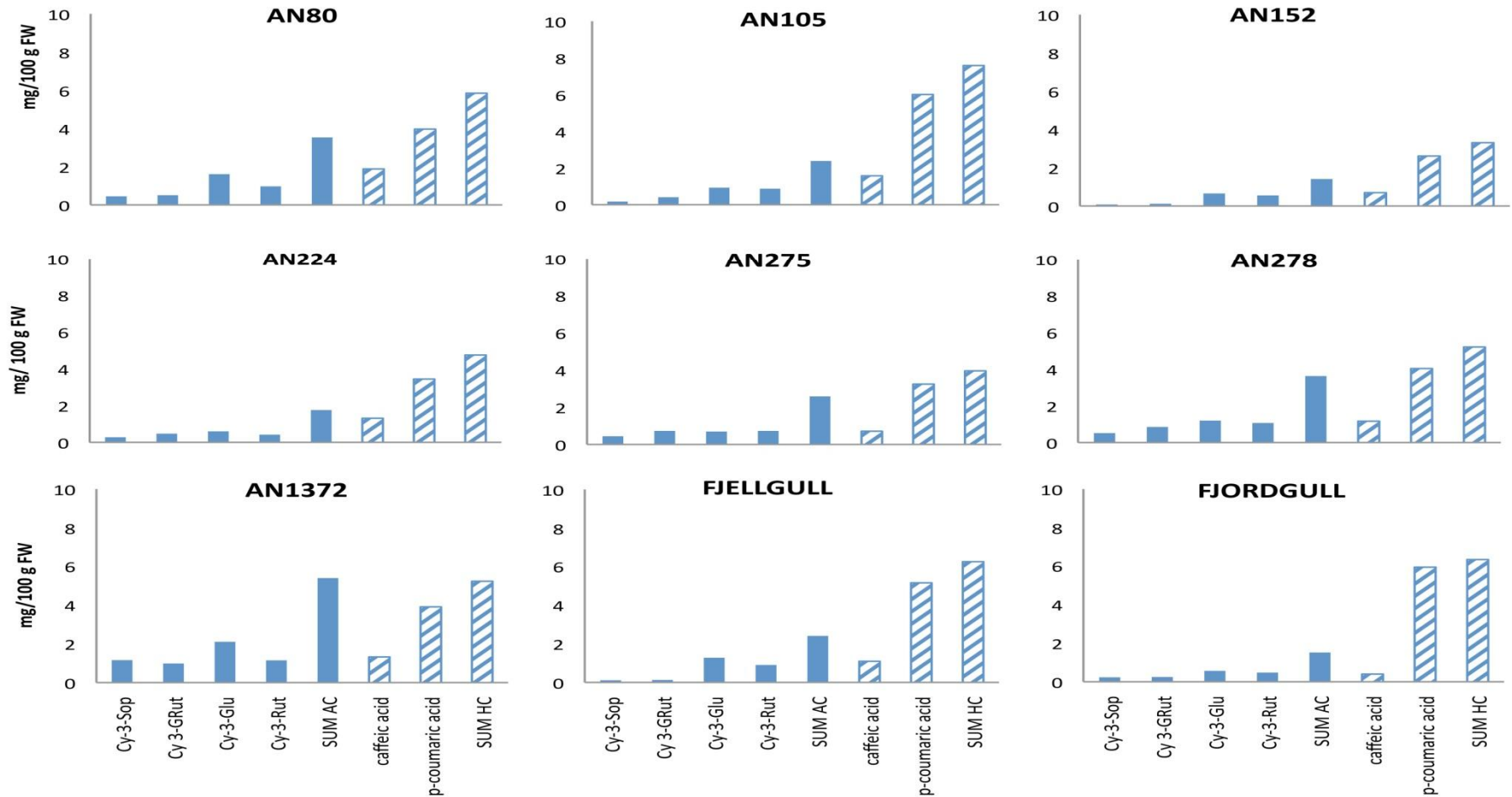
Quercetin 3-O-[6''-(3-hydroxy-3-methylglutaroyl)-β-glucoside

ACMS- based on temperature

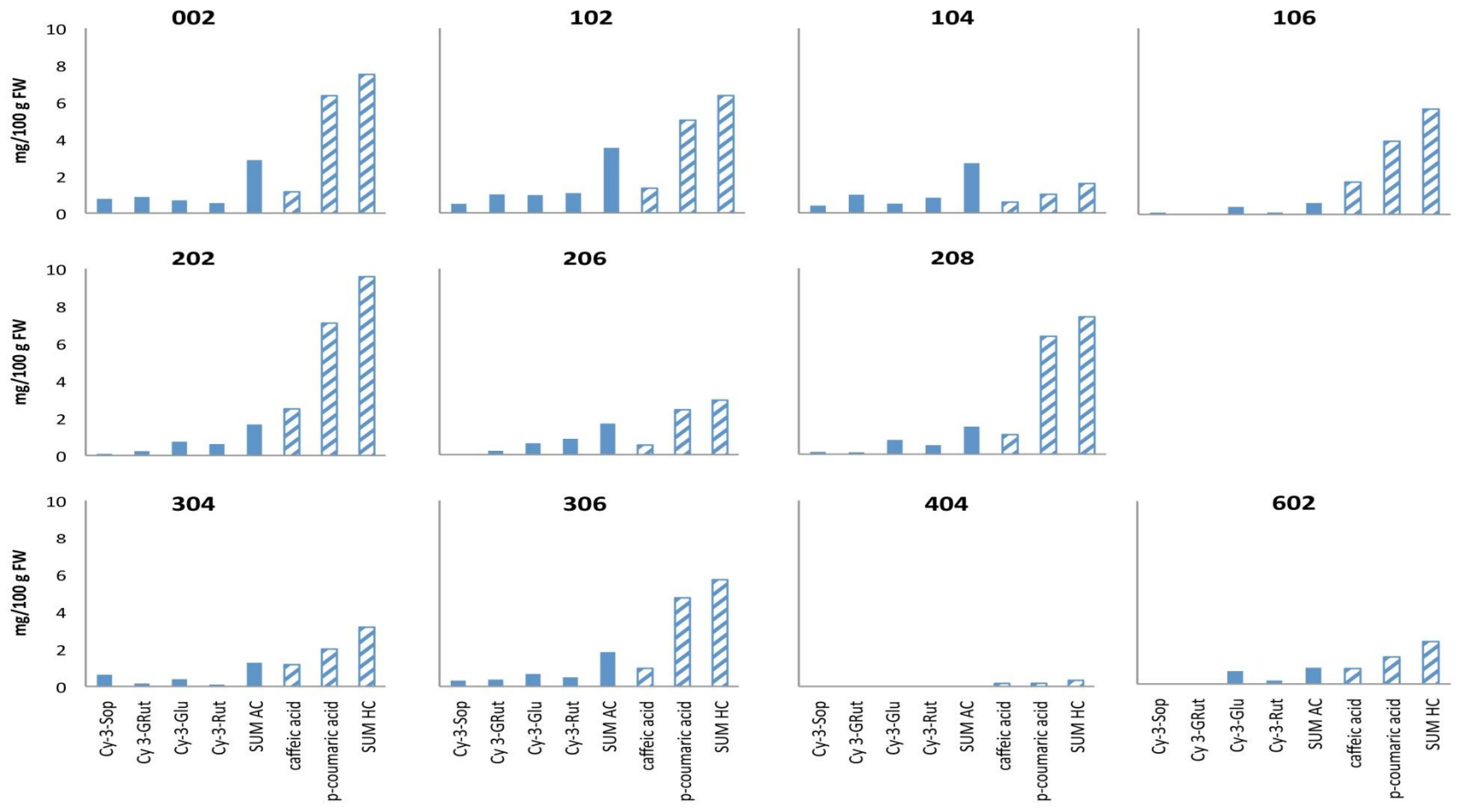


Individual anthocyanins and hydroxycinnamic derivatives varies between clones

Trost et al. 2011 Acta Agric Scand



Individual anthocyanins and hydroxycinnamic derivatives varies between clones



Thank you!

