

# **Short term scientific mission (STSM) within the COST863 Euroberry research: from genomics to sustainable production, quality and health**

## **STSM scientific report 2009**

### **Bioactive compounds in strawberry fruit from different genotypes and production sites**

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Period: From February 15<sup>th</sup> to March 15<sup>th</sup> 2009

Reference code: COST-STSM-863-04413

## **1 Objectives of the mission**

The aim of this mission was to gain the sufficient knowledge in HPLC methods for the analysis of specific bioactive compounds and taste-related compounds in strawberry fruits. By doing so I aimed to characterise six strawberry genotypes cultivated in two different locations in Switzerland. The lyophilised strawberry samples were prepared and provided by the home institution and sent to the host institution (Cranfield University) prior to the start of the mission.

During this short-term scientific mission, I also had the chance to be involved in a strawberry post harvest experiment in which the mechanism of action of methyl-jasmonate on strawberry was investigated.

## **2 Material and methods**

### **2.1 Plant material and sample preparation**

Cold stored A+ plants of six strawberry cultivars were planted in two different locations in Conthey and in Bruson (Switzerland) in July 2007. Both sites are characterized by different soil type and elevation over sea level. During plant growth and fruit production the same fertirrigation and phytosanitary treatments were applied in both sites. Fruits were harvested between May and July 2008.

The samples were harvested on the 7<sup>th</sup> harvest (14 days after harvest begin) on pooled fully ripe fruits of 28 plants per replication. The entire fruits were immediately frozen at -20°C and stored up to two months. Then fruits were snap frozen in liquid nitrogen and milled with a lab blender. The obtained powder was kept at -80°C for up to 4 months until they were freeze dried. The freeze-dried fruit powder was vacuum-packed and sent to the host institute (Cranfield University) before the start of the mission.

### **2.2 Chemical characterisation of the strawberry cultivars**

To characterize the strawberry cultivars, we focused on bioactive compounds such as anthocyanins (cyanidin-3-glucoside, pelargonidin-3-glucoside and derivatives) and also parameter related to sensory quality of strawberries such as non structural carbohydrates (sucrose glucose and fructose) as well as non volatile organic acids (L-ascorbic, citric and malic acid).

Analysis of the target analytes were performed on Agilent 1200 series HPLC equipped with either photodiode array detector (PAD) or refractive index detector (RID).

Non structural carbohydrate were extracted with 62.5 % methanol in water for 15 minutes at 55 °C and analysed as described by Terry et al. (2007) using a RID detector. Organic acids were extracted with water at room temperature for 5 minutes and analysed as described by Terry et al. (2007) using a PDA detector at 219 nm. For the analysis of anthocyanins, extraction was performed at 35 °C for 90 minutes with two different extraction solvent. The extracts were analysed as described by Giné Bordonaba & Terry (2008) with a PDA detector at 520 nm.

A total of 48 samples were analysed for each of the target analytes corresponding to 6 cultivars x 4 replication x 2 locations.

### **2.3 Work carried out during the visit**

Week 1:

- registration and introduction in the laboratory (safety procedures and lab rules)
- learning of the HPLC use
- methods adjustments (different extraction solvent and different mobile phases)

- Week 2 - extraction and measure of the anthocyanins content in 48 strawberry samples  
- set up of the strawberry post harvest trial
- Week 3 - extraction and measure of the sugars content in 48 strawberry samples  
- preparation and analysis of samples from the post harvest trial.
- Week 4 - extraction and measure of organic acids in 48 strawberry samples  
- analysis of samples of the post harvest trial  
- analysis of the results and report

### 3 Main results

A typical anthocyanin profile of strawberry cultivar (sample 119) is shown in figure 1. Unknown peaks 1 and 2 were identified as pelargonidin derivative by comparing their absorbance spectra with pelargonidin standard.

Pelargonidin-3-glucoside remained the main anthocyanin present in the strawberry samples. The content within the samples varied from 902.6 to 2379.2  $\mu\text{g/g}$  dry weight.

The anthocyanin profile varied strongly among the cultivars.

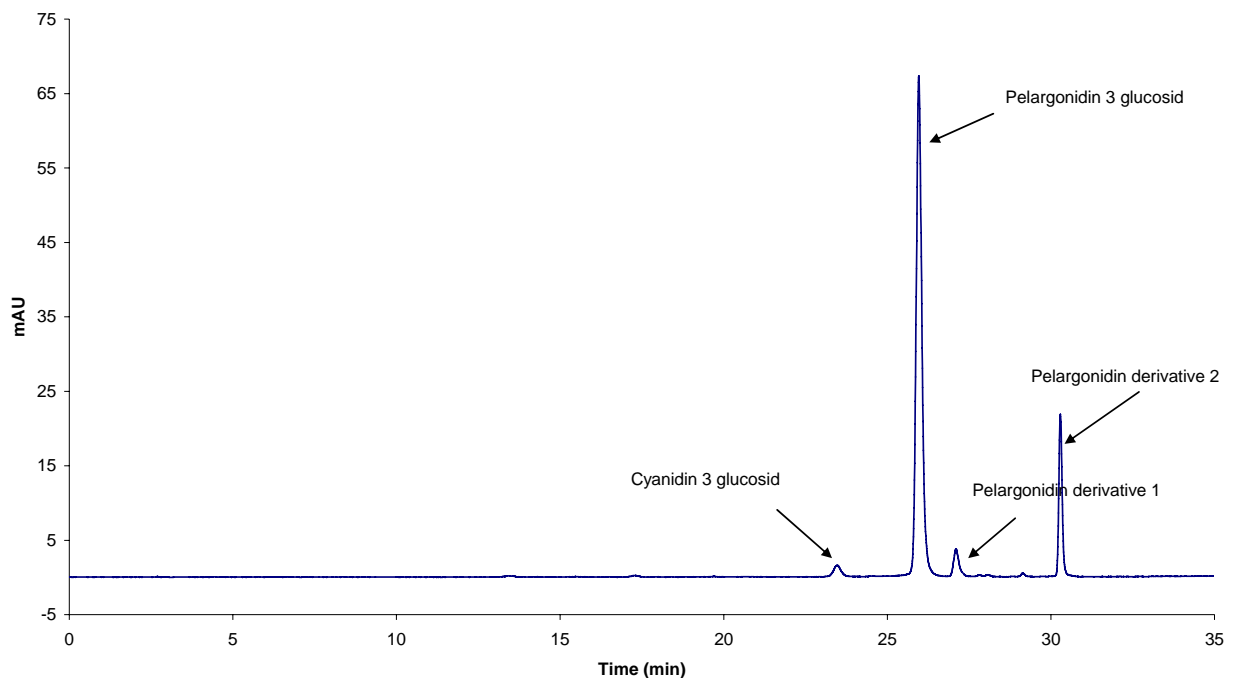


Figure 1: recorded DAD spectrum at 520 nm of a strawberry extract.

A typical carbohydrate profile of two strawberry samples is shown in Figure 2. Sucrose, glucose and fructose were identified in all the samples. The total sugar content calculated as the sum of sucrose, glucose and fructose contents varied from 532.6 to 648.5 mg/g dry weight according to the cultivar and site of production. However, no significant correlation was found between total sugar content and the soluble solid content (% Brix) of the fruits. The relative amount of each sugar varied considerably between the cultivars and cultivation sites (data not shown).

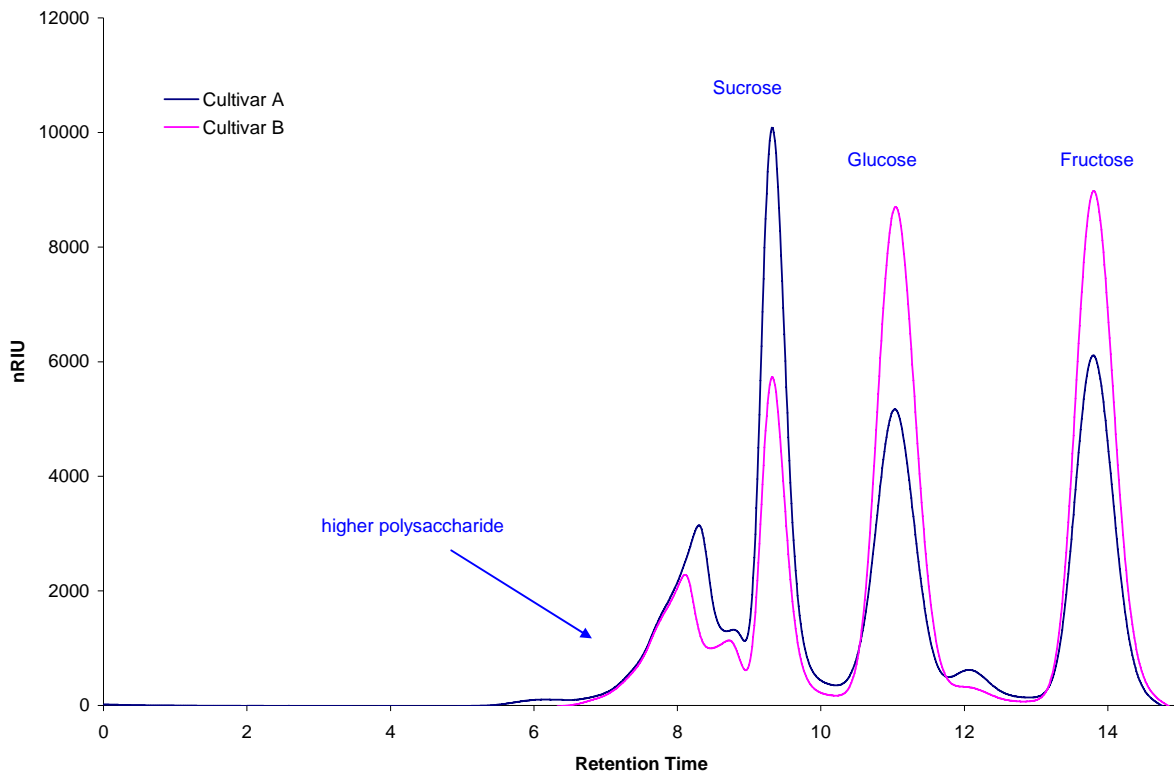


Figure 2: Carbohydrate profile in two strawberry cultivars

## 4 Conclusion

The objectives of the mission were achieved. I acquired the necessary knowledge for the use of HPLC method for the determination of anthocyanins, sugars and organic acids in strawberries. Additionally, the data obtained during this short term scientific mission suggested that differences existed in anthocyanin and sugar profiles between the different genotype studied. So we can say that the chosen target analytes (anthocyanins, sugars and organic acids) allowed differentiating between the strawberry cultivars and the environmental factors related to the site of production.

Further analyses of the results are in progress and we are aiming to write a joint publication with the host institution.

I would like to take the opportunity to thank COST institution to make this visit possible. I also thank Dr. Leon Terry for hosting me in his laboratory and for his scientific support and Jordi Giné Bordonaba for his help and friendship.

## 5 References

1. BORDONABA, J. G. & TERRY, L. A. (2008). Biochemical profiling and chemometric analysis of seventeen UK-grown black currant cultivars. *Journal of Agricultural and Food Chemistry* **56**(16), 7422-7430.
2. TERRY, L. A., CHOPE, G. A., & BORDONABA, J. G. (2007). Effect of water deficit irrigation and inoculation with *Botrytis cinerea* on strawberry (*Fragaria x ananassa*) fruit quality. *Journal of Agricultural and Food Chemistry* **55**(26), 10812-10819.