

Genetic analysis of Volatiles and Flavour in Potatoes



David Lloyd¹, Glenn Bryan¹, Mark Taylor², Gavin Ramsay¹, Christine Hackett³, John Bradshaw¹

¹Genetics Programme, SCRI, Invergowrie, Dundee, UK

²Plant Products and Food Quality Programme, SCRI, Invergowrie, Dundee, UK

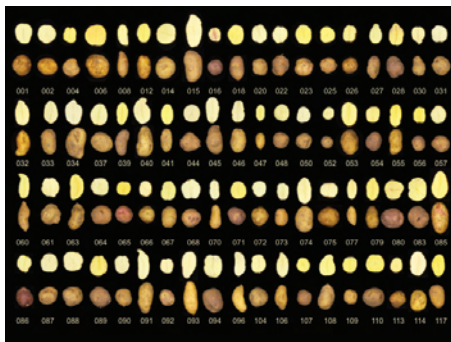
³Biomathematics and Statistics Scotland (BioSS), SCRI, Invergowrie, Dundee, UK

Introduction

Potato flavour and texture are traits of increasing importance as drivers of consumer choice. Previous efforts to identify genetic factors influencing such traits have suffered from a lack of variation among commercial varieties. We have expanded the phenotypic variability by use of our unique population of long-day adapted diploid *Solanum phureja* clones, known to possess strong flavours as well as unusual textural properties.

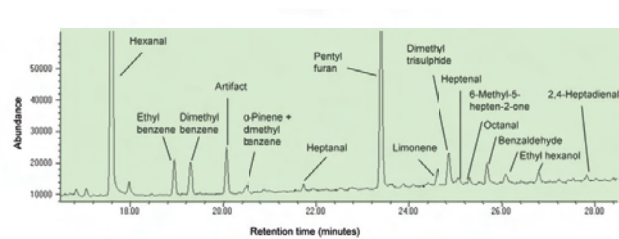
Population development

Hybrid clones resulting from an initial cross between diploid *S. tuberosum* clone 2DH40 and *S. phureja* clone DB337(37) (the variety Mayan Gold) were used in backcrosses to both parents. One of the four hybrid populations (FT.4) was taken forward for genetical studies of sensory and volatile characteristics of potato. A sample of tubers from different clones of the FT.4 population is shown in the figure below.



Headspace volatile analysis

The headspace volatiles of cooked tubers were profiled for 119 individuals of the FT4 population. Volatiles were entrained on Tenax TA polymer over two hours. These were then analysed by ATD GC-MS. Integrated peak areas were normalised against that of a non-intrinsic standard that was added to the cooked tuber matrix.

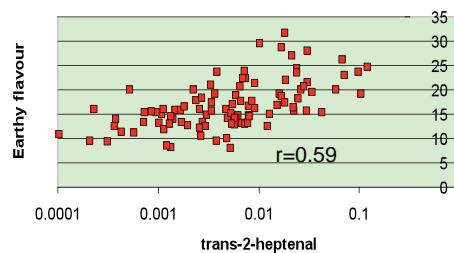


A representative section of ATD-GC/MS total ion chromatogram trace of cooked *phureja/tuberosum* hybrid potato tubers, showing a number of flavour-related volatile organic compounds.

Correlation of volatile compounds with sensory attributes

The FT4 population had been profiled for a spectrum of organoleptic traits by a sensory evaluation panel in a previous study.

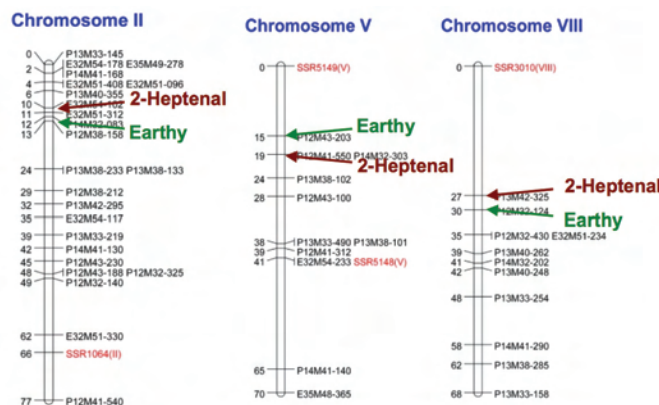
A number of correlations between headspace volatile content and these sensory traits were found, most notably between volatiles derived from lipid oxidation (for example, aldehydes) and earthy flavour and aroma.



Correlation of earthy flavour and trans-2-heptenal content in headspace

QTL analysis of volatile and sensory data

The FT4 population had previously been subjected to linkage analysis, in which a genetic map was constructed using around 250 molecular markers (AFLPs and SSRs). Volatile and sensory data were then subjected to Kruskal-Wallis Quantitative Trait Loci (QTL) analysis, revealing more than 100 significant QTLs, a number of them co-segregating, suggesting possible causative linkages.



Co-segregation of QTLs for earthy flavour and trans-2-heptenal on chromosomes II, V and VIII

Summary

QTLs for volatiles and sensory traits have been identified for the first time in potatoes. Some QTLs for volatiles co-segregate with sensory traits, indicating possible causative linkages. This, along with further, on-going biochemical analyses will pave the way for the identification of candidate genes and other functional studies.