

Diversity of volatile and non-volatile compounds in a gene bank collection of cultivated *Daucus carota* L.

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Introduction

Cultivated carrots contain several volatile and non-volatile substances which contribute significantly to health and sensory quality. In this context especially carotenoids as well as volatile monoterpenoids are relevant [1, 2]. For a comprehensive screening of cultivated *Daucus carota* L. genotypes one hundred accessions were selected for the analysis of non-volatile and volatile compounds. For this, all genotypes were analysed for their carotenoid and sugar content in the roots and for volatile compounds in the leaves. Subsequently, all data sets were statistically calculated aiming to get a better overview of the variation of plant substances within the selection of cultivated *Daucus* genotypes. Furthermore, possible correlations between volatiles and non-volatile substances were verified.



Fig. 1 Different cultivated *Daucus* genotypes

Material and Methods

Plant material

100 different genotypes of cultivated *Daucus carota* L. were grown under standardised conditions in a greenhouse for 100 days [fig.1]. This material comprises a selection from different gene banks and represents all climates of *Daucus* cultivation.

Extraction and Analysis of non-volatile compounds

After harvest carrots were cut into 1x1 cm cubes, deep frozen, lyophilised and powdered. Carrot powder (0.5 g) was extracted using accelerated solvent extraction ASE. Subsequently the concentrate was filtered into a HPLC vial and analysed of individual carotenoids applying HPLC-DAD. For determination of the sugar concentration 0.1 g of carrot powder was extracted with acetonitrile and water (80:20; v/v) for 15 minutes. The resulting concentrate was filtered into an HPLC vial and analysed using HPLC-RI.

Extraction and Analysis of volatile compounds

The patterns of volatile metabolites were determined by a rapid, non targeted analysis approach. This method is a combination of rapid sample preparation and non-targeted data processing. It consists of automated headspace solid phase micro extraction and data processing by pattern recognition.

Details of the sample preparation and GC separation have been described by Dunemann et al., 2009 [3].

Results and Discussion

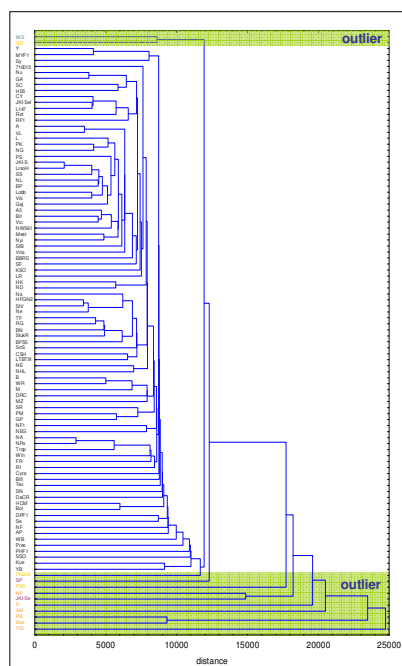


Fig. 2 Cluster analysis of volatile compounds in the leaves of 100 cultivated carrot genotypes (single linkage eucd. distance)

The statistical computation of a dataset from 100 cultivated carrot genotypes for the distribution of volatile and non-volatile compounds is shown in figures 2 and 3. Figure 2 shows the cluster analysis of volatile compounds (mono- and sesquiterpenoids) in carrot leaves while figure 3 shows the statistical evaluation of carotenoids (α -, β -carotene and lutein) in carrot roots. As shown in figure 2 twelve genotypes are outliers because of their divergent of volatile substances. A correlation between carrot colour and volatiles has not been found.

In fig. 3 the carotenoid data set of 100 genotypes shows only five outlying genotypes. The discrimination of these genotypes is mainly related to the unusual carotenoid profile. Four of them are orange while one has a purple colour. By taking a deeper look into the measured data all outliers show high content of at least one carotenoid.

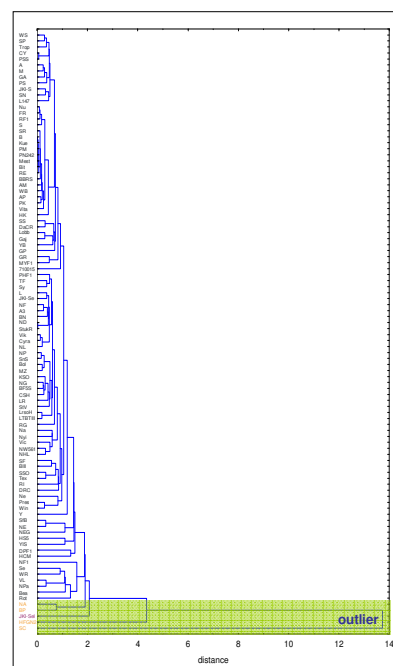


Fig. 3 Statistical computation of alpha-, beta-carotene and lutein in the carrot roots of 100 cultivated carrot genotypes (single linkage eucd. distance)

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