CHAPTER 109

Varietal Differences in the Volatile Profile of Bananas with Resistance to Black Leaf Streak Disease

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109.1 INTRODUCTION

Largely appreciated all over the world, bananas are the fourth largest agricultural crop and Brazil is the fourth largest world producer, with more than 7 million ton/year [1]. This production is almost entirely absorbed by the domestic market, due to the importance of this fruit in the population's diet. However, the main cultivars commercialized in Brazil are susceptible to the fungus *Mycosphaerella fijiensis* Morelet, the causer agent of the black leaf streak disease (black Sigatoka) which, depending on conditions, may cause losses in production of up to 100% [2].

As an alternative measure to counteract the spread of this disease, the Brazilian Agricultural Research Corporation (Embrapa) is developing new resistant varieties [3]. Before these materials are made available to producers, their flavors must be evaluated. Since flavor is the interaction of aroma and taste components with the human senses [4], the objective of this study was to compare the volatile profile of two popular banana cultivars in Brazil, Prata and Pacovan, both susceptible to black Sigatoka, with some of their resistant hybrids: Vitoria, Maravilha, Galil 18, Preciosa, Fhia 18, Pacovan Ken, Garantida, Japira, and PA 4268.

109.2 MATERIALS AND METHODS

109.2.1 Extraction of Volatile Compounds

A portion of 10 g of unfrozen banana pulp, crushed with 40% NaCl, was added to 10 ml of water and put into a 40 ml vial with PTFE/silicone

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septa. DVB/CAR/PDMS (50/30 µm film thickness) fibers (Supelco, Bellefonte, CA, USA) for solid phase microextraction (SPME) were duly conditioned according to the manufacturer's instructions. Fibers were exposed to the samples' headspace under the following conditions: equilibrium and extraction time of 15 and 60 min, respectively, both at 25°C under agitation.

109.2.2 GC-MS Analysis

A Shimadzu GC-2010 (Kyoto, Japan) equipped with a mass spectrometer detector Shimadzu QP-2010 (GC-MS) was used for the identification of volatile compounds. A CP-Wax 52 CB (Agilent, 30 m × 0.25 mm i.d. × 0.25 µm film thickness) column was used for separation. The following instrumental conditions were used: injector at 200°C in splitless mode for 2 min; helium as carrier gas at 1.0 ml/min; oven temperature gradient 50–150°C, at a rate of 2°C/min and hold of 5 min at the maximum temperature. Compounds were tentatively identified by comparison of the mass spectra with those provided by the library of the National Institute of Standards and Technology (NIST, Gaithersburg, MD, USA), and comparison of retention indices (Kovats), calculated from a homologous series of alkanes, with the elution order of compounds found in the literature [4–7].

109.2.3 Statistical Analysis

Multivariate data analysis was performed by principal component analysis (PCA) using the chromatogram peak areas of the 23 selected compounds: 13 esters, 7 alcohols, 2 ketones, and an aldehyde. These compounds were chosen based on their amounts in the samples and their importance to the overall aroma of banana, according to literature [4,8,9] and previous work.

109.3 RESULTS AND DISCUSSION

PCA results indicated that 60.65% of the information content can be represented in a subspace formed by two coordinates (principal components) as shown in Figure 109.1. PA 4268, Vitoria and Garantida, plotted very closely to each other in the upper left region, showed greater amounts of 2-methylbutyl isopentanoate, 2-methyl-1-propanol, and 1-butanol. Compounds arranged in the upper right region, such as butyl butanoate, isobutyl acetate, isopentyl acetate, and especially 2-methylbutyl 2-methylbutanoate, are characteristic of FHIA 18 and Preciosa, which showed similar volatile profiles. Maravilha cultivar showed to be poor in volatile compounds.

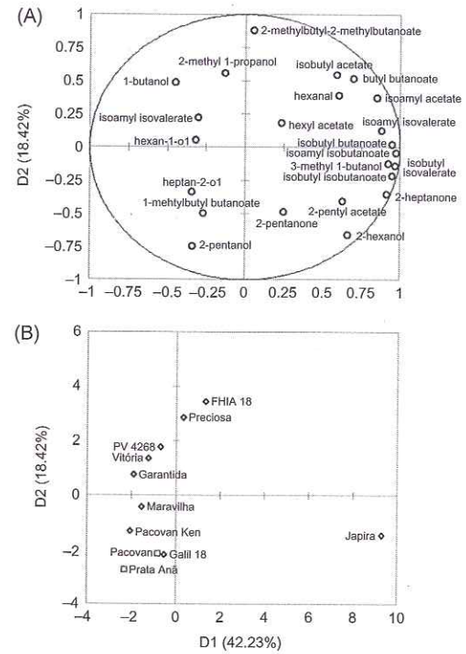

Figure 109.1 Principal component analysis (PCA) of volatile compounds from different banana cultivars: (A) volatile compounds loadings; (B) factor scores for banana cultivars.

The non-resistant varieties, Prata Anã and Pacovan, and their hybrids Galil 18 and Pacovan Ken, respectively, showed similar profiles, mainly characterized by compounds 2-heptyl butanoate, 2-pentanol, and 2-heptanol, located in the lower left region of the graph. It is important to note that these volatiles are not major compounds in the banana cultivars, but Prata Anã, Pacovan, Galil 18, and Pakovan Ken presented a higher amount of these compounds when compared with other bananas. Based on such results it is possible that Galil 18 and Pakovan Ken have the potential to replace the susceptible cultivars without impairing their characteristic flavor.

On the other hand, Japira cultivar showed a quite different profile from that of traditional Prata Anã and Pacovan. Despite such evidence, this cultivar seems to be promising in terms of flavor because of its rich volatile profile, composed mainly of esters with characteristic aromas of banana, such as isopentyl acetate, isopentyl butanoate, isobutyl butanoate, isopentyl isobutanoate, and isopentyl isopentanoate.

109.4 CONCLUSION

The banana cultivars that presented volatile profiles more similar to Prata Anã and Pacovan were Galil 18 and Pacovan Ken. Cultivar Japira presented the richest volatile profile, characterized by the presence of many esters commonly found in bananas. Although more study in terms of production and sensory analysis is needed, it was possible to identify that Galil 18, Pakovan Ken, and Japira cultivars are promising materials and may replace the commercial cultivars susceptible to black leaf streak disease.

ACKNOWLEDGEMENT

The authors are thankful to Frutacor Farm for their support.

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CHAPTER 110

The Role of Ethyl-β-D-Glucoside in the Pleasantness of Sea Buckthorn Juice

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110.1 INTRODUCTION

Sea buckthorn (*Hippophaë rhamnoides*) berries are known to be very acidic, sour, and astringent [1,2]. The berries also contain various sugar alcohols and alkylated sugars, and the contents vary during ripening [3]. Our study examined the effect of ethyl-β-D-glucoside on sensory properties (taste and astringency) and on the pleasantness of sea buckthorn juice. Three samples from two varieties were chosen for this study: a variety with naturally high contents of ethyl-β-D-glucoside (picked optimally ripe, A, and slightly over-ripe, B, with a month between harvests) and another with a lower content of ethyl-β-D-glucoside (optimally ripe = control, C). All the plants were grown in the same place and in the same conditions in the south-west of Finland.

110.2 MATERIALS AND METHODS

Three cold-pressed juice samples were prepared. Thirty-nine voluntary subjects were asked to rate the taste pleasantness of the juices on a nine-point balanced hedonic scale (1 = dislike extremely, 9 = like extremely). Data were collected by Compusense *five* software (Compusense, Guelph, Canada).

The intensities of four predetermined sensory attributes (sourness, bitterness, soft and velvety astringency, and rough, puckering astringency) were evaluated from the juices by a trained panel (n = 26). The panel evaluated intensities from the samples on a generalised labeled magnitude

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