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CHAPTER 118

Volatile Profile of New Improved Brazilian *Capsicum chinense* Peppers

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118.1 INTRODUCTION

Capsicum peppers have a significant international market [1]. Their attributes such as pungency, color, aroma, and flavor are desirable in a variety of culinary dishes around the world, which make them widely appreciated. In order to expand the Brazilian *Capsicum* agribusiness, the Brazilian Agricultural Research Corporation (Embrapa) is carrying out a breeding program in order to develop new genotypes with characteristics of agronomical and industrial interest. Besides the capsaicin content, which is responsible for the burning sensation, the program is looking after strains able to add aroma and flavor to foods [2]. In the present work, the volatile profile of two accessions of the Embrapa's Pepper Active Germplasm Bank, with strong pungency, was compared to the profile of a very scented and not pungent Brazilian variety, called Orange Biquinho.

118.2 MATERIALS AND METHODS

Fruits of CNPH 3931 (a yellow Murupi), CNPH 4080 (a Cumari-do-Pará), and Orange Biquinho, all *Capsicum chinense* Jacquin cultivars [3], were harvested at Embrapa Vegetables, in Brasília, and transported by air to Embrapa Tropical Agroindustry, in Fortaleza, Ceará. Fruits were washed and stored frozen (−18°C).

The extraction of volatile compounds was performed by solid phase mircoextraction (SPME). DVB/CAR/PDMS fiber was exposed to

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the headspace of 10 g crushed samples for 45 min at 65°C. A Shimadzu GC-2010/QP-2010 was used for the separation and identification of volatile compounds. Chromatographic conditions were: DB-5 MS column (J&W, 30 m × 0.25 mm i.d. × 0.25 μm f.t.), injection in the splitless mode at 250°C, helium as the carrier gas (1.5 mL/min), and oven temperature from 50°C to 120°C at 5°C/min and then to 180°C at 2°C/min. Compounds were identified by comparison of mass spectra with those provided by the NIST library with the aid of Kovats indices (KI) [4,5].

118.3 RESULTS AND DISCUSSION

The volatile profiles of CNPH materials were very similar to each other. Compounds were mostly the same, varying in amounts for a few compounds. Major compounds were also the same: 3,3-dimethylcyclohexanol, esters hexyl pentanoate, (Z)-3-hexenyl pentanoate, hexyl isopentanoate, hexyl 2-methylbutanoate, heptyl isopentanoate, citronellyl isopentanoate, decyl pentanoate, and the terpene trimethyl-methylene-bycicloundecene (Table 118.1).

Biquinho pepper showed a higher number of compounds (41) than CNPH 3931 (34) and CNPH 4080 (32), presenting more compounds of higher volatility (KI ≤ 1200), while the new materials presented more compounds of lower volatility (KI ≥ 1800). Biquinho also presented 17 more trace compounds that were not included in Table 118.1. However, its total chromatogram area was only about half of that of the other genotypes. 3,3-Dimethylcyclohexanol and the last three esters cited above were also major compounds in the Biquinho sample, but almost always in much fewer quantities.

In a previous work on Orange Biquinho's aroma-active compounds [6], 3,3-dimethylcyclohexanol was described as "fried, onion" with low intensity; citronellyl and heptyl isopentanoate as "green" (medium to high); decyl pentanoate and hexyl 2-methylbutanoate as "pepper" (low); hexyl isopentanoate and (Z)-3-hexenyl pentanoate as "spicy" (medium to high). Hexyl pentanoate, described as "fruity, citric," was present in large quantities in CNPH samples, while heptyl butanoate, described as "pepper, floral" has only been identified in high amounts in Orange Biquinho pepper.

The number and quantity of compounds with "pepper-like" notes was higher in Orange Biquinho than in the other analyzed genotypes. While Biquinho showed 18 compounds with this description (including trace

Table 118.1 Headspace Volatile Profile of *Capsicum chinense* Jacquin Peppers

			Area Counting (×10^5)		
Peak	Volatile Compounds	KI	CNPH 3931	CNPH 4080	Biquinho
1	pentanal	≤900	–	–	3.6
2	4-methyl-1-pentanol	≤900	–	–	5.6
3	ρ-xylene	≤900	–	–	2.8
4	isopentyl isopentanoate	1106	12.9	4.8	0.7
5	pentyl isopentanoate	1112	–	–	23.5
6	hexyl isobutanoate	1133	12.8	34.2	1.5
7	hexyl butanoate	1147	6.3	5.7	3.2
8	(Z)-3-hexenyl butanoate	1150	–	–	3.5
9	hexyl 2-methylbutanoate	1199	92.7	100.3	73.5
10	hexyl pentanoate	1207	649.4	723.6	7.5
11	α-citronellol	1221	59.4	64.4	67
12	(Z)-3-hexenyl isopentanoate	1232	14.4	4.7	14.4
13	(Z)-3-hexenyl pentanoate	1235	123.4	99.8	52.9
14	hexyl isopentanoate	1244	228.1	124.6	60.6
15	heptyl isobutanoate	1247	–	27.5	24.8
16	heptyl butanoate	1290	–	–	191.8
17	heptyl pentanoate	1303	16.2	4.5	7.5
18	octyl isobutanoate	1308	4.3	19.3	65.6
19	n.i.*	1311	25.3	6.4	–
20	hexyl hexanoate	1315	16.3	29.8	45.4
21	heptyl 2-methylbutanoate	1335	30.0	25.0	34.8
22	heptyl isopentanoate	1342	156.1	174.1	147.9
23	α-cubebene	1348	9.5	–	–
24	hexyl hexanoate	1353	6.4	–	–
25	2-methyl tridecane	1366	10.7	3.8	5.9
26	3,3-dimethylcyclohexanol	1381	782.4	876.7	300.5
27	n.i.*	1400	–	–	75.3
28	decyl pentanoate	1402	92.1	143.3	82.3
29	octyl 2-methylbutanoate	1433	12.3	10.6	14.1
30	octyl isopentanoate	1439	64.5	36.6	69.7
31	1,1-dimethyl-2-nonilcyclopropane	1446	75.1	86.3	35.5
32	α-himachalene	1451	26.1	28.2	30.4
33	2-methyl tetradecane	1464	32.0	31.9	17.9
34	tetramethylbenzocycloheptene	1479	214.7	180.5	24.9
35	trimethylmethylenobycicloundecene	1482	–	14.0	–
36	n.i.*	1485	–	–	24.3
37	citronellyl isobutanoate	1488	17.6	44.1	29.8
38	α-muurolene	1496	–	–	6.8
39	squalene	1571	–	–	14.2
40	citronellyl isopentanoate	1574	151.2	191.9	98.9

(*Continued*)

Table 118.1 (Continued)

Peak	Volatile Compounds	KI	Area Counting ($\times 10^5$) CNPH 3931	CNPH 4080	Biquinho
41	n.i.*	1616	–	–	62.5
42	n.i.*	1640	–	–	17.5
43	pentadecanal	1677	–	–	7.0
44	α-cardinol	1687	–	–	31.6
45	pentadecenol (Z)-6-acetate	1860	11.5	–	–
46	isocamphone	1892	1.2	42.7	4.8
47	octadecyl acetate	1897	18.2	12.9	–
48	oleic acid	1923	94.8	103.8	–
49	dimethyl tetradecenol acetate	1958	9.2	151.8	–
50	9-hexadecenoic acid	1968	32.7	–	–

*n.i., not identified

compounds), with an area of 522×10^5, CNPH 3931 and CNPH 4080 presented seven and eight compounds, totaling 353×10^5 and 466×10^5, respectively.

Many compounds found in the Biquinho sample with "sweet," "floral," and "fruity" notes [6] were only found in the novel materials in small quantities or were not detected (pentyl isopentanoate, pentanal, squalene, α-cardinol, and others). Orange Biquinho showed 13 peaks (21.3%) described with these odor notes, while CNPH 3931 and CNPH 4080 showed only nine, representing 26.5% and 24.3% of peaks, respectively.

118.4 CONCLUSION

CNPH 3031 and CNPH 4080 presented very similar volatile profiles, with fewer compounds than Orange Biquinho, described as a very aromatic pepper, but with higher volatile quantity, which were represented by a larger chromatogram area. The new genotypes lack some important compounds to Biquinho's sweet, floral, fruity, and pepper notes. However, the presence of some desirable esters can add a variety of pleasant notes to food preparations as citric, green, and spicy. These peppers are promising materials but could undergo future cross breeding to enhance their flavor.

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