Volatile Fraction of Fool's Watercress (*Apium nodiflorum*) as a New Spice Herb and Ingredient for Salads

Carla GUIJARRO-REAL[1], Ana M. RIBES-MOYA[1], Ana FITA[1], Jaime PROHENS[1], Adrián RODRÍGUEZ-BURRUEZO[1]*

[1]*Instituto de Conservación y Mejora de la Agrodiversidad Valenciana. Universitat Politècnica de València, Spain.*
***)**Corresponding author, e-mail: adrodbur@doctor.upv.es

BulletinUASVM Horticulture 72(2) / 2015
Print ISSN 1843-5254, Electronic ISSN 1843-5394
DOI:10.15835/buasvmcn-hort:11645

Abstract

This work displays the preliminary results of a study of the volatile fraction of fool's watercress (FW) (*Apium nodiflorum*), an underutilized vegetable species with potential use for salads and as spice. A comparative study of the volatile fraction of FW samples from Northern Valencia periurban area and samples from relatives parsley and celery was performed by head-space solid phase microextraction (HS/SPME) and GC-MS analysis. The profile of FW was richer than the profile of celery and parsley and resulted as a mixture of those ones. Moreover, some volatiles like isothiocyanates were identified as specific of FW. Thus, the flavour of this species can be considered similar to its relatives but more intense and consequently, may be used in salads or even as spice herb.

Keywords: aroma, celery relatives, flavour, gas chromatography, mass spectrometry.

Introduction

For centuries, humans have collected wild species from the nature. Nowadays, many of them, despite being undomesticated, are part of the ethnobotanical heritage of different cultures and still remain utilized by rural population (Leonti *et al.,* 2006). Some of those species have shown a great adaptation to new environmental conditions which are derived from human activity. Thus, watercress (*Nasturtium officinale* W.T. Aiton) and the less known fool's watercress (FW) (*Apium nodiflorum* (L.) Lag.) grow profusely in irrigation channels and can be easily harvested and used as a complement of the diet. In particular, *A. nodiflorum*, a species of the *Apiaceae* family, is eaten fresh added in salads or even boiled in soups for increasing the taste of many dishes, in the same way than celery. In addition, its intense flavour and taste could offer new potential uses as a spice herb. Unfortunately, the knowledge about its flavour/aroma active compounds is nil, which is a key subject for breeding programs aimed to its future commercial exploitation.

Aims

The present work was aimed to perform a comparative study on the volatile fraction of FW and its relatives celery (*A. graveolens* L. var. *dulce* (Mill.) Pers.) and parsley (*Petroselinum crispum* (Mill.) Nyman).

Materials and Methods

A fool's watercress population located in the irrigation channels of Camino de Vera (Universitat Politècnica de València, Valencia, Spain) was analyzed and compared with commercial samples of celery and parsley from the Central Market of Valencia. The volatile fraction was extracted with the head space/solid phase microextraction technique (HS/SPME) and analyzed by GC-MS according to the protocol described by Rodríguez-Burruezo *et al.* (2010). Volatiles were identified

Table 1. Volatile profile (peak area units x10^6) of fool's watercress (FW) and relatives parsley (Par) and celery (Cel).

	RI[a]	FW	Par	Cel		RI	FW	Par	Cel
Sesquiterpenes					Aromatic hydrocarbons				
Non-oxygenated compounds					Isothiocyanates				
(+)cyclosativene	1125	45,41	tr[b]	--[c]	3-methylbutyl isothiocyanate	1040	2,82	--	--
α-ylangene	1221	1,73	2,38	--	4-methylpentyl isothiocyanate	1136	7,91	--	--
α-copaene	1222	227,50	102,94	--	1-hexyl isothiocyanate	1185	2,57	--	--
α-cubebene	1344	2,74	11,89	--	1-heptyl isothiocyanate	1253	1,72	--	--
δ-elemene	1377	313,27	--	--	1-octyl isothiocyanate	1354	3,34	--	--
β-elemene	1398	26,61	--	4,69	nonyl isothiocyanate	1458	0,94	--	--
β-gurjunene	1403	5,96	10,92	--	3-methylhexyl isothiocyanate	---	8,75	--	--
α-bergamotene	1430	0,91	6,25	--	Thiazoles				
(Z)-β-farnesene	1440	163,60	--	--	4-Ethyl-5-methylthiazole	1021	6,41	--	--
α-farnesene	1458	361,61	--	2,19	Alcohols				
β-caryophyllene	1494	0,62	292,29	380,01					
Monoterpenes					(Z)-3-Hexen-1-ol,	868	5,19	3,37	25,68
					3-Hexen-1-ol	868	34,96	1,84	--
β-pinene	943	741,49	54,82	34,14	(Z)-5-octen-1-ol,	1067	1,80	--	--
β-myrcene	943	271,87	819,86	80,36	phenylethyl alcohol	1134	38,42	--	--
α-pinene	948	30,12	72,78	11,37	Other compounds				
(E)-β-ocimene	976	837,70	--	465,62					
β-ocimene	976	108,81	90,81	236,02	(Z)-3-hexen-1-ol, acetate,	992	3,79	--	--
γ-terpinene	998	255,58	13,78	112,02	Benzeneacetaldehyde	1081	11,20	--	--
sylvestrene	1018	2,02	--	--	2-nonenenitrile	1169	1,65	--	--
limonene	1018	2408,75	--	1801,32	Hexahydropyrrolizine-3-thione	1222	20,86	--	--
(Z)-limonene oxide	1031	8,27	--	--	Benzenepropanenitrilo	1231	5,43	--	--
limonene epoxide	1031	2,57	--	--	4-methylbenzyl cyamide	1252	2,49	--	--
α-terpinolene	1052	3,55	1171,26	104,10	Oxime-, methoxy-phenyl	1301	5,89	7,05	5,78
Norcarotenoids									
β-ionone	1457	8,73	--	--					

[a]RI = retention index. [b]tr = traces (<0,01x10^6 peak area units). [c]-- = not detected

with reference standards, if possible, or tentatively by comparing the mass spectra with the NIST library.

Results

FW presented a volatile fraction which resulted as a mixture of those ones identified in celery and parsley but richer (Table 1). A total of 46 compounds were tentatively identified for FW. On the contrary, around 30 volatiles were identified in celery and parsley. Some compounds were found in the three species, especially monoterpenes, while others did not appear in at least one of them. In particular, some volatiles, i.e. β-ionone, sylvestrene and the group of isothiocyanates were specifically found in the species of study. According to these results, the flavour and aroma of fool's watercress can be considered similar to celery but more intense and with green notes typical from parsley and carrots.

Conclusion

This work is the first report of the volatile fraction of *A. nodiflorum*. Particular aroma and flavour of fool's watercress is due to a specific combination of typical volatiles from celery and

parsley, with specific grassy/green notes due to sulphur compounds isothiocyanates. The results suggest that there are real opportunities to promote this species as an ingredient for salads and/or spice use.

Acknowledgements: Carla Guijarro-Real thanks Ministry of Education, Culture and Sport for being granted with a predoctoral grant for the Formation of University Professors (FPU).

References

1. Leonti, M.; Nebel, S.; Rivera, D.; Heinrich, M. 2006. Wild gathered food plants in the European Mediterranean: a comparison analysis. Economic Botany, 60: 130 - 142.
2. Rodríguez-Burruezo, A.; Kollmannsberger, H.; González-Mas, M.C.; Nitz, S.; Nuez, F. 2010. HS-SPME comparative analysis of genotypic diversity in the volatile fraction and aroma-contributing compounds of Capsicum fruits from the *annuum-chinense-frutescens* complex. Journal of Agricultural and Food Chemistry, 58: 4388 - 4400.