5-1-1992

Major essential oil constituents of Agastache spp.

D. J. Charles
Purdue University

J. E. simon
Purdue University

C. Glowacki
Purdue University

Mark P. Widrlechner
United States Department of Agriculture, isumw@iastate.edu

Major essential oil constituents of Agastache spp.

Abstract

The essential oils from the USDA germplasm collection of anise hyssop (Agastache foeniculwn), catnip giant hyssop (A. nepetoides) and Korean mint (A. rugosa) and putative hybrids were field-grown and harvested during full bloom. The leaves were dried and the essential oils extracted via hydrodistillation to identify the major chemical constituents. Methyl chavicol was found to be the major compound in most accessions, and accounted for >92% of the total essential oil in six lines and one putative hybrid. Results indicated a wide range in the relative concentrations of other compounds (cx-limonene, menthone, methyl eu,geno!, bornyl acetate, spathulenol, cadinol and !3-caryophyllene) and in essential oil content.

Disciplines

Agricultural Science | Agriculture | Horticulture | Plant Sciences

Comments

This article is from *Acta Horticulturae* 306 (1992): 327–329.

MAJOR ESSENTIAL OIL CONSTITUENTS OF *AGASTACHE* SPP.

D. J. Charles, J. E. Simon * and C. Glowacki
Dept. of Horticulture, Purdue University, West Lafayette, IN 47907, USA

M.P. Widrlechner
United States Department of Agriculture - Agricultural Research Service, North Central Reg. Plant Intro. Sta., Iowa State University, Ames, IA 50011, USA

ABSTRACT

The essential oils from the USDA germplasm collection of anise hyssop (*Agastache foeniculum*), catnip giant hyssop (*A. nepetoides*) and Korean mint (*A. rugosa*) and putative hybrids were field-grown and harvested during full bloom. The leaves were dried and the essential oils extracted via hydrodistillation to identify the major chemical constituents. Methyl chavicol was found to be the major compound in most accessions, and accounted for >92% of the total essential oil in six lines and one putative hybrid. Results indicated a wide range in the relative concentrations of other compounds (α-limonene, menthone, methyl eugenol, bornyl acetate, spathulenol, cadinol and β-caryophyllene) and in essential oil content.

INTRODUCTION

Anise hyssop (*Agastache foeniculum* [Pursh] Kuntze), native to the Great Plains, USA and Canada; catnip giant hyssop (*A. nepetoides* [L.] Kuntze) native to eastern and central USA and Canada; and Korean mint (*A. rugosa* [Fisch. & C.A. Mey.] Kuntze) native to China, Korea and Japan are perennial aromatic plants of the Lamiaceae (formerly Labiatae) which are grown for their culinary and ornamental value. Plants of this genus have been used for flavoring beverages, as a spice in foods, against colds (1), and as honeybee forage. While *Agastache* spp. have long been grown for their culinary and ornamental value, little is known about the essential oils responsible for the plants' aroma and fragrance (2,3,4,5). Recently, Nykanen et. al (3) analyzed the essential oil of a single plant of *A. foeniculum* from Canada and identified 39 constituents, with methyl chavicol (74.6%) as the major constituent. This study further characterizes the essential oils of *A. foeniculum*, and examines the major essential oil constituents of *A. rugosa*, *A. nepetoides*, and putative hybrids between *A. foeniculum* and *A. rugosa* in order to identify genetic diversity within the *Agastache* spp.

METHODS

The United States Department of Agriculture (USDA) Plant Introduction collection of 19 lines of Agastache spp. were field-grown at the North Central Regional Plant Introduction Station, Ames, Iowa (Clarion loam soil) in 1989 and evaluated for their aromatic qualities. A commercial source of anis-hyssop (Agastache foeniculum) was field-grown at the Purdue University Vegetable Research Farm, Lafayette, Indiana (Oakley silt loam soil) in 1989 for comparative purposes. Plants were harvested at the bloom stage and dried in a forced-air oven at a temperature of 35°C. Essential oil was extracted by hydrodistillation (clevenger trap) from dried leaves (6) and oil content determined on a volumetric basis (ml/g). The composition of essential oil was analyzed by gas chromatography (GC) and verified by GC/Mass spectrometry as previously described (6). A dried plant specimen of each USDA line was deposited in the Iowa State University Ada Hayden Herbarium, Ames.

RESULTS

The amount of oil obtained by hydrodistillation ranged from 0.07% to 2.73% (leaves) on a dry weight basis (Table 1). The major essential oil constituents of the *Agastache* spp. include methyl chavicol, α-limonene, menthone, methyl eugenol, bornyl acetate, spathulenol and β-caryophyllene (Table 1). The commercial source of *A. foeniculum* grown in a separate location contained 88% methyl chavicol and had a similar chemical profile to many of the *A. foeniculum* germplasm accessions. Bornyl acetate was present in *A. foeniculum* but absent in *A. rugosa* and absent in half the hybrids where *A. rugosa* served as the female parent. Spathulenol, one of the major constituents in several *A. foeniculum* accessions and in *A. nepetoides* oil, was detected only in minor concentrations in the *A. rugosa* or hybrid oil (Table 1). In the single accession of *A. nepetoides* (A4716) that was evaluated, δ-cadinol was the major constituent (39.6%) in the oil. This compound was only found in this one line. Cadinol was absent, except for A4546 among *A. foeniculum*, although present in low concentrations in all *A. rugosa* lines.

The entire profile of oil composition could not be accounted for in several *Agastache* spp. by the 8 reported constituents. This can be seen in those accessions with very low concentrations of methyl chavicol (e.g. A3481, A4546). Further analysis of the essential oil from these lines is required to identify the additional constituents present but not reported in this study.While it is possible that some accessions were not harvested at exactly the same degree of bloom, these results do clearly demonstrate the wide genetic diversity in the essential oil composition within and between the *Agastache* spp.

CONCLUSIONS

Nykanen et. al (3) reported that the essential oil from *A. foeniculum* contained methyl chavicol (74.6%), α-limonene (8.5%), β-caryophyllene (5.5%), and germacrene B (3.3%) as the plant's major constituents. Although our results are in agreement with theirs regarding the major chemical constituents, several of our accessions contained much greater concentrations of methyl chavicol (>90%). The degree to which the environment influences the expression of methyl chavicol still needs to be examined. Bornyl acetate, a major constituent in our oil, was not identified in the oil analyzed by Nykanen et. al (1989) nor did we find germacrene B in any accession. Our results demonstrate that there is a wide range in both the yield of essential oil and the relative content of the major chemical constituents in the essential oil within these species.

REFERENCES

1. Gildemeister, E. and Hoffmann, E., Fr. Die Atherischen Ole, Akademie - Verlag, Berlin, Band VII, 87, 1961.
2. Fujita, S.I. and Y. Fujita. Miscellaneous contributions to the essential oils of plants from various territories XXXIII. Essential oil of *Agastache rugosa* O. Kuntze. Yakugaku Zasshi 93:1679-1681, 1973.
3. Nykanen, I., Holm, Y., and Hiltunen, R. Planta Medica, 55:314, 1989.
4. Polak, E.H. and R.M. Hixon. The volatile oil from *Lophanthus anisatus* Benth. J. Amer. Pharm. Assn. 35:240-243, 1945.
5. Zamureenko, V.A., N.A. Kliuev, M.G. Mumladze, L.B. Dmitriev and I.I. Grandberg. Studies on the composition of essential oil of *Lophanthus anisatus (Agastache foeniculum)*. Izv. Timiriyazev. Skh. Akad. Nov/Dec: 164-166, 1980.
6. Charles, D.J. and J.E. Simon. 1990. Comparison of extraction methods for the rapid determination of essential oil content and composition of basil. J. Amer. Soc. Hort. Sci. 115:458-462.

ACKNOWLEDGEMENTS

Published as Journal Paper No. 12,807 of the Purdue University Agriculture Experiment Station, West Lafayette, Indiana, USA, 47907. This work was supported in part by grants from the Purdue University Agric. Exp. Sta. (Specialty Crops Grant). We express our appreciation to Karl Wood, Campus-Wide Mass Spectrometry Laboratory for discussions on compound identification and his review of this manuscript.

Table 1. Major essential oil constituents in the leaves of *Agastache* spp.[z]

			Selected Oil Constituents (relative percentage of total essential oil)							
Agastache species	USDA No.	Oil Content (% Vol/dwt)	Methyl chavicol	α-limonene	menthone	Methyl eugenol	bornyl acetate	spathulenol	cadinol	β-caryophyllene
A. foeniculum	A3064[y]	0.80[x]	92.1	0.4	--	0.8	0.4	--	--	0.3
	A3481	0.07	13.5	--	--	--	28.9	33.0	--	2.2
	A4546	0.28	6.7	0.1	--	--	1.4	10.5	15.6[u]	12.3
	A4550	0.36	17.9	0.9	0.9	--	18.7	45.6	--	1.6
	A4569	0.20	6.3	2.5	1.1	--	18.1	49.5	--	2.4
	A7611	0.91	77.7	5.8	0.2	1.5	2.5	0.1	--	0.6
	A7765	1.06	92.5	0.4	--	--	0.4	0.4	--	0.4
	A7872	2.45	92.6	2.5	0.1	--	0.2	0.1	--	0.6
	A7988	1.08	94.6	0.3	--	0.5	0.4	0.1	--	0.6
	A8001	0.82	82.1	4.9	--	--	1.1	2.2	--	1.0
A. nepetoides	A4716	0.18	6.5	0.1	--	--	0.1	17.4	39.6[t]	16.5
A. rugosa	A4721	1.53	92.3	4.4	0.1	0.1	--	0.3	0.3[u]	0.8
	A4992	2.73	93.7	2.1	0.1	--	--	0.2	0.3[u]	1.9
	A5018	2.12	56.0	10.7	8.5	9.1	--	0.4	0.7[u]	1.5
	A7722	1.92	80.2	6.8	0.6	0.1	--	0.1	0.3[u]	0.8
Hybrids[w]	A4721	1.53	84.6	7.8	0.3	0.1	0.4	0.1	--	0.7
	A4992	1.56	71.1	13.8	3.1	--	0.45	0.3	--	1.2
	A5018	1.74	46.7	14.4	3.3	15.2	--	0.5	0.9[u]	1.6
	A7722	1.47	92.8	2.8	0.6	1.7	--	--	--	0.4
Commercial *A. foeniculum*[v]	----	1.95	88.1	2.2	--	2.7	<0.1	--	--	0.13

[z]From leaves only harvested during full bloom.

[y]The 'A' preceding each number = Ames.

[x]To convert % oil (vol/dwt) to µg dwt multiply by 10.

[w]Hybrids are *A. rugosa* as the female parent and *A. foeniculum* as the male.

[v]Source: Companion Plants, Athens, Ohio.

[u]α-cadinol

[t]δ-cadinol