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Chemical Features of Some Essential Oils of *Ocimum basilicum* L. from Benin

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Abstract

Essential oils from leaves of *Ocimum basilicum* collected in different areas of Benin were analyzed by GC and GC/MS. Two chemotypes were identified, one rich in methyl chavicol (87-90%) and the other containing linalool (45.3%), eugenol (15%), (Z,Z)-α-farnesene (6.7%) and T-cadinol (5%).

Key Word Index

Ocimum basilicum, Labiatae, essential oil composition, linalool, eugenol, methyl chavicol.

Introduction

In Benin, *Ocimum basilicum*, known commonly as basil, is called akohoun and kessou-kessou in Fon and Goun, koklodame in Mina, ofin in Yoruba and Nagot (1).

This species, of Asian origin, is now cultivated in many African and European countries. In Benin it can be found in plantations and kitchen gardens. It is a herbaceous, woody plant, thickly ramified and odoriferous, growing to up to a metre in height.

O. basilicum is purported to possess many therapeutic virtues. For example, its aerial parts are used alone in aqueous decoctions, or in association with the leaves of *Hyldegardia barteri*, as a drink or bath for the treatment of elevated blood pressure. In association with the leaves of *Cymbopogon citratus* (Poaceae) and *Alchormea cordifolia*, it is used in the treatment of drepanocytosis (2). It is traditionally used to relieve the effects of venom in snake and scorpion bites, and to treat gastritis, constipation, diabetes, coughs and colds, etc (3). However, this plant is used chiefly as flavoring for cooking and as a component of condiment mixtures.

O. basilicum comprises many chemotypes. A classification developed by Guenther (4), Zola and Garnero (5) and the *Conservatoire National des Plantes à Parfums, Aromatiques, Médicinales et Industrielles* (CNPPMAI) (6), based on geographical origin and main constituents of oils, recognizes four types (Table I).

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Table I. Main types of *Ocimum basilicum* by origin

Ocimum basilicum	Geographical area	Main constituents
European type (linalool-rich sweet basil)	Europe USA North Africa	linalool (40%) methyl chavicol (25%)
Reunion type (methyl chavicol-rich)	Reunion Comores Madagascar	methyl chavicol (89%) traces of linalool
Type containing traces of methyl cinnamate	Bulgaria Sicily Egypt India Haiti	linalool methyl chavicol traces of methyl cinnamate
Eugenol-rich type	Java ex-USSR Seychelles Morocco	linalool eugenol

This early classification offers no insight into the results of the shikimic and(or) mevalonic pathways. Latter work showed the existence of numerous distinct chemotypes rich in: linalool (40-50%) (7,8), methyl chavicol (66-86%) (4-7,9-15), methyl cinnamate (64-68%) (16), 1,8-cineole (49-60%) (8,17), dihydrotagetone (82%) (18), camphor (34%) (8), together with two intermediate types: linalool/methyl chavicol (5,19,20) and linalool/trans methyl cinnamate (21-23).

Here we report a study of *O. basilicum* that currently occur in Benin, to classify them in terms of the other varieties described, and to select those liable to be of economic value for Benin.

Experimental

Plant Material: This was collected between March and August 1994 at four wild locations; two at or near Cotonou, and two in the hinterland (towns of Savè and Pobè). Several samples were collected at each location and average results were obtained. Voucher specimen were deposited in herbarium of CENAP (Centre National d'Agro-Pédologie) of Calavi.

Oil Isolation: The oils were steam-distilled for 2 h from fresh leaves.

Analysis: GC analysis of oils was performed on a Delsi 121 C instrument with flame ionization detection and temperature programming: 5 min at 50°C and 50°-210°C at 2°C/min, on a WCOT fused silica column (25 m x 0.3 mm: df: 0.15 μm; stationary phase CP WAX 52 CB); identification was by co-injection with reference compounds and by GC/MS using a VG 70 spectrometer: 70 eV, WCOT fused silica column (50 m x 0.3 mm; df: 0.25 μm; CP WAX 52 CB; temperature programming: 50°-230°C at 3°C/min, with He as carrier gas.

Results and Discussion

Average yields of oils obtained from plants collected in and near Cotonou were 0.13-0.35%; they were higher (0.5% to 0.76%) for the inland samples (Pobè and Savè).

Analysis of the oils (Table II) revealed two chemical types:

- Linalool-rich (45.3%) with much eugenol (15%) and some (Z,Z)-α-farnesene (6.7%) and T-cadinol (5%).
- Methyl chavicol-rich (87% to 90%), containing only small amounts of 1,8-cineole (2.5% to 4.5%) and (Z,Z)-α-farnesene (1.4% to 2.5%).

Table II. Percentage composition of *Ocimum basilicum* oils by harvest location

Compounds	Cotonou (Minnontin)	Cotonou (Airport)	Pobè (in town)	Savè (in town)
α-Pinene	0.1	t	0.2	t
β-Pinene	0.1	0.1	0.5	0.1
Sabinene	t	0.1	0.2	t
Myrcene	0.2	t	0.2	t
α-Terpinene	0.1	-	-	0.1
Limonene	0.4	0.1	0.1	1.9
1,8-Cineole	1.4	2.5	4.5	t
γ-Terpinene	0.5	0.1	t	0.1
(E)-β-Ocimene	2.3	0.4	0.2	0.2
p-Cymene	0.3	t	t	t
Terpinolene	0.2	t	-	t
(Z)-3-Hexenol	1.5	-	-	-
cis-Linalool oxide*	0.5	-	-	0.1
Linalool	45.3	0.8	-	0.2
$C_{15}H_{24}$	6.7	2.5	1.3	3.6
Methyl chavicol	1.0	87.0	89.8	86.7
(E)-β-Farnesene	0.6	0.1	-	0.2
α-Terpineol	1.8	0.7	-	0.9
Geranial	0.8	-	-	3.5
β-Bisabolene	-	2.2	0.3	-
Geranyl acetate	0.3	-	-	-
Nerol + Calamenene*	0.2	-	-	-
Geraniol	0.8	-	-	-
Methyl eugenol	1.7	0.1	-	0.1
Nerolidol*	0.1	0.2	-	-
Eugenol	14.9	-	-	t
T-Cadinol	5.0	0.5	-	t
Thymol	t	0.1	-	t
Total (%)	86.8	97.5	97.3	97.7
Yield (%)	0.1	0.4	0.8	0.5

t = trace (≤0.05%); *correct isomer not identified

The first type was comparable to the European type, although it differed by the presence of non-negligible amounts of farnesene and T-cadinol. The second type resembled the Reunion methyl chavicol-type. However, we also found farnesene and 1,8-cineole, in smaller concentrations than before (4,5). Interestingly, the two types occur in both the sandy region of Cotonou (seaboard) and inland.

References

1. S. de Souza, *Flore du Bénin.* **3**, 337-338 (1989).
2. E. J. Adjanohoun, *Contribution aux études ethnobotaniques et floristiques en République du Bénin*, ACCT, Paris (1975).
3. Y. Mahmout, *Contribution à l'étude de quelques aromates et condiments utilisés au Tchad.* Thèse de Doctorat, Université de Montpellier II, p 107 (1992).
4. E. Guenther, *The Essential Oils.* Allured Publ. Corp. Carol Stream, IL, Vol. 1 (1948); Vol. 2 (1949); Vol. 3 (1949); Vol. 4 (1950); Vol. 5 (1952); Vol. 6 (1952). Reprints 1972-1998.
5. A. Zola and J. Garnero, *Contribution à l'étude de quelques essences de basilic du type européen.* Parf. Cosm. Savons France, **3**, 15-19 (1973).
6. B. Pasquier, *Contribution à l'étude morphologique de quelques espèces et variétés du genre Ocimum et constitution d'une banque de gènes*, CNPPMAI, Milly-la-Forêt, France, p 4 (1990).

7. H. H. Peter and M. Rémy, *Essence de basilic,étude comparative.* Parf. Cosm. Arômes, **21**, 61-68 (1978).
8. M. Dethier, *Contribution à l'étude des plantes aromatiques du Brundi.* Thèse de Doctorat, Montpellier II (1996).
9. B. C. Gulati, A. S. Shawl, S. N. Garg, S. N. Sobti and P. Pushpagadan, *Essential oil of Ocimum canum Sims (linalool type).* Indian Perfum., **21**, 21-25 (1977).
10. B. M. Lawrence, R. H. Powel and D. M. Peele, *Proceedings of "8th International Congress of Flavours Fragrances and Essential Oils."* Grasse, p 111 (1980).
11. R. Randriamiharisoa and E. M. Gaydou, *Relation entre la teneur en linalol et le pouvoir rotatoire dans les essences de basilic.* Parf. Cosm. Arômes, **64**, 89-90 (1985).
12. R. Randriamiharisoa, E. M. Gaydou, J. P. Bianchini, G. Ravelojaona and G. Vernin, *Etude de la variation de la composition chimique et classification des huiles essentielles de basilic de Madagascar.* Sci. Aliment., **6**, 221-231 (1986).
13. O. Ekundayo, *Chemical composition of two basil oils produced from Ocimum basilicum growing at two different locations in Nigeria.* Personal communication (1987).
14. B. M. Lawrence, *A further examination of the variation of Ocimum basilicum L.* In: *Flavors and Fragrances: A World Perspective.* Edits., B. M. Lawrence, B. D. Mookherjee and B. J. Willis, Elsevier Sci. Publ. BV, Amsterdam (1988).
15. J. A. Pino, E. Roncal, A. Rosada and I. Goire, *The essential oil of Ocimum basilicum L. from Cuba.* J. Essent. Oil Res., **6**, 89-90 (1994).
16. J. J. Brophy and M. K. Jogia, *Essential oils from Fijian Ocimum basilicum L.* Flav. Fragr. J., **1**, 53-55 (1986).
17. A. Bélanger, L. Dextraze, M. Nacro, A. D. Samaté, G. Collin, F. X. Garneau and H. Gagnon, *Compositions chimiques d'huiles essentielles de plantes aromatiques du Burkina Faso.* Actes des 13èmes Journées Internationales Huiles Essentielles, Digne-les-Bains, France, pp 300-305 (1994).
18. G. Ruberto, A. Spadaro, M. Piattelli, F. Piozzi and S. Passannanti, *Volatile flavour components of Ocimum basilicum L. var. hyspidum (Lam.) Chiov.* Flav. Fragr. J., **6**, 225-227 (1991).
19. F. Tatéo, L. Santamaria, L. Bianchi and A. Branchi, *Basil oil and tarragon oil: Composition and genotoxicity evaluation.* J. Essent. Oil Res., **1**, 111-118 (1989).
20. M. M. Carmo, E. J. Raposo, F. Venancio, S. Frazao and R. Seabra, *The essential oil of Ocimum basilicum L. from Portugal.* J. Essent. Oil Res., **2**, 263-264 (1990).
21. Z. Fleisher and A. Fleisher, *Volatiles of Ocimum basilicum traditionally grown in Israël. Aromatic plants of the Holy Land and the Sinai, Part VIII.* J. Essent. Oil Res., **4**, 97-99 (1992).
22. M. J. Perez-Alonso, A. Velasco-Negueruela, M. Emin Duru, M. Harmandar and J. L. Esteban, *Composition of the essential oils of Ocimum basilicum var. glabratum and Rosmarinus officinalis from Turkey.* J. Essent. Oil Res., **7**, 73-75 (1995).
23. T. Ozek, S. H. Beis, B. Demirçakmak and K.H.C. Baser, *Composition of the essential oil of Ocimum basilicum L. cultivated in Turkey.* J. Essent. Oil Res., **7**, 203-205 (1995).