

Composition of the essential oils from the leaves of two varieties of *Aspilia africana* (Pers.) C. D. Adams from Cameroon

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ABSTRACT: Four essential oil samples obtained by hydrodistillation from the leaves of *Aspilia africana* var. *africana* and a corresponding sample of *A. africana* var. *ambigua* were analysed by GC and GC–MS. The two varieties were poor in essential oil content (<0.1%). The qualitative composition of the essential oils was found to be quite similar, irrespective of the area and date of plant collection. Marked differences were, however, observed in the quantitative composition of the oils from the two varieties. As far as *A. africana* var. *africana* is concerned, two oil samples from Bafoussam were rich in sesquiterpenes (88% and 94%) with germacrene-D (45% and 54%) as the major component, while two oil samples from Yaound  contained mainly monoterpenes (63% and 48%) with α -pinene (39% and 27%) as the most abundant component. The variety *A. africana* var. *ambigua* afforded an essential oil rich in monoterpenes (54%) with limonene (23%) and α -pinene (22%) as predominating components. Finally, the insect antijuvenile hormone precocene I was found to be present in all samples of the two varieties. Copyright   1999 John Wiley & Sons, Ltd.

KEY WORDS: *Aspilia africana* (Pers.) C. D. Adams var. *africana*; *Aspilia africana* (Pers.) C. D. Adams var. *ambigua*; Asteraceae; Heliantheae; essential oil; α -pinene; limonene; germacrene-D; GC–MS analysis

Introduction

Aspilia africana (Pers.) C. D. Adams (Asteraceae, tribe Heliantheae) is a more or less perennial herb. It is a widespread weed that occurs in Africa, usually with deep yellow flowers; the plant species is very variable and is divided into many varieties.¹ The two varieties described to occur in Cameroon are *A. africana* var. *africana* and *A. africana* var. *ambigua*.²

A. africana var. *africana*, also known as *Aspilia helianthoides* Chev., is a spreading herb or scrambling shrub up to 6 ft high.¹ *A. africana* var. *ambigua* has also been described as *Wedelia africana* Pers.;¹ it is a weed of cleared ground in dry forest countries with a golden-yellow ligule.

In Cameroon, the two varieties are used in traditional medicine for the treatment of wounds, headache and cough in new-born infants.² In Senegal, the variety *africana* is used to reduce labour pains in women.³ *A. africana* has been an object of biological studies. In particular, its antibacterial⁴ and anticoagulant⁵ effects and its nutritional value⁶ have been reported. Previous chemical investigations of *A. africana* and related

species indicate the presence of sesquiterpenes and diterpene lactones as well as fatty acids.^{7–9} To the best of our knowledge, the essential oils of *A. africana* have not yet been studied. We present in this paper the results of a chemical analysis of five essential oil samples obtained by hydrodistillation from the leaves of two varieties of *A. africana* collected in two regions of Cameroon.

Experimental

Plant Material and Isolation Procedure

Leaves of flowering plants of *A. africana* var. *africana* were collected in Yaound  (central region of Cameroon) in July 1993 and July 1994 (samples Y1 and Y2), and in Bafoussam (western region) in January 1994 and August 1994 (sample B1 and B2). Leaves of *A. africana* var. *ambigua* were collected in Bafoussam in August 1994. The plant identification was performed at the National Herbarium in Yaound  where voucher specimens (numbers HNC 36018 and HNC 36021) were deposited.

Batches of 2 kg of fresh leaves from the two varieties were submitted separately to hydrodistillation for 12 h

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Table 1. Percentage composition of five essential oil samples from two varieties of *Aspilia africana* (Pers.) C. D. Adams from Cameroon

Compounds	RI*	Var. <i>africana</i>				Var. <i>ambigua</i>
		Y1	Y2	B1	B2	
Monoterpenes		62.7	48.4	10.7	0.1	54.1
Monoterpene hydrocarbons		62.1	48.4	9.8	0.1	54.1
α -Thujene	925	tr	tr	–	–	tr
α-Pinene	934	38.7	26.5	2.6	–	21.8
Camphene	944	0.6	tr	–	–	1.1
Sabinene	968	5.5	5.1	tr	–	2.4
β -Pinene	974	7.4	6.7	0.1	–	3.8
Myrcene	981	1.4	tr	tr	tr	tr
α -Phellandrene	1000	0.1	tr	tr	tr	1.4
α -Terpinene	1015	tr	tr	tr	tr	tr
Limonene	1024	7.5	9.4	7.1	tr	23.3
β -Phellandrene	1026	tr	tr	tr	0.1	0.3
(<i>Z</i>)- β -Ocimene	1028	0.2	tr	tr	–	tr
(<i>E</i>)- β -Ocimene	1039	0.7	0.7	tr	–	tr
γ -Terpinene	1045	tr	tr	tr	tr	tr
Oxygenated monoterpenes		0.6	tr	0.9	tr	tr
Linalol	1084	0.2	tr	0.9	tr	tr
Terpinen-4-ol	1170	0.4	tr	tr	tr	–
α -Terpineol	1176	tr	tr	tr	–	–
Sesquiterpenes		31.5	50.9	88.2	94.0	39.4
Sesquiterpene hydrocarbons		30.7	48.8	83.0	92.5	35.1
α -Cubebene	1369	0.2	tr	tr	tr	3.9
α -Ylangene	1379	tr	tr	tr	tr	0.8
α -Copaene	1384	tr	tr	tr	tr	0.4
β -Cubebene	1391	0.7	0.5	1.4	1.1	2.1
β -Elemene	1394	0.9	1.4	4.0	2.0	2.2
β -Copaene	1402	tr	tr	1.0	1.1	–
(<i>E</i>)- β -Bergamotene	1409	0.3	tr	tr	tr	1.2
β -Caryophyllene	1429	6.0	4.1	8.7	13.2	5.8
(<i>E</i>)- β -Farnesene	1448	–	–	tr	4.3	tr
α -Humulene	1461	2.0	2.7	5.9	4.1	1.2
Germacrene-D	1487	13.8	24.4	45.0	54.2	6.7
β -Bisabolene	1491	1.0	2.5	tr	tr	0.8
Germacrene-B	1493	1.1	2.3	5.1	1.7	3.1
C ₁₅ H ₂₄	1495	1.9	6.3	4.3	2.1	1.7
α -Muurolene	1498	tr	tr	tr	0.5	0.1
δ -Cadinene	1518	2.8	4.6	7.6	8.2	5.1
Oxygenated sesquiterpenes		0.8	2.1	5.2	1.5	4.3
Spathulenol	1574	0.2	0.6	2.9	tr	2.0
Caryophyllene epoxide	1576	0.1	0.6	tr	tr	1.4
Humulene epoxide	1612	tr	tr	tr	tr	0.2
δ -Cadinol	1624	0.5	0.9	2.3	1.5	0.7
Chromene		tr	tr	0.5	1.8	5.6
Precocene I	1440	tr	tr	0.5	1.8	5.6

* Retention indices on OV-101 column. Y1, Y2, B1, B2 are samples from Yaoundé and Bafoussam, respectively. tr = trace (<0.05%).

using a Clevenger-type apparatus as described in the French Pharmacopoeia.¹⁰ The oils obtained were dried over anhydrous sodium sulphate before analysis to determine their chemical composition.

Identification of Components

For the analysis of the composition of the oils, we used GC and combined GC–MS. The GC analyses were carried out on two fused-silica columns (25 m \times 0.32 mm i.d.), coated with OV-101 and Carbowax 20M,

respectively; the oven temperature was programmed from 50°C to 200°C at 5°C/min.

The GC–MS analyses were performed on a Hewlett-Packard GC–quadrupole MS system (Model 5970) fitted with a 25 m \times 0.32 mm i.d. fused-silica column coated with DB-1, using the same chromatographic parameters as above, and on a Perkin-Elmer GC–MS system (Sigma 3B/VG7070P) fitted with a CP-Wax 51 column (50 m \times 0.2 mm i.d.); the oven temperature was programmed at 5 min at 50°C, then 50–220°C at 2°C/min. Published mass spectra, retention indices as well as authentic reference compounds were used for the identification of the oils constituents.^{11–14}

Results and discussion

The essential oils were obtained in a 0.08% yield irrespective of the date and place of plant collection as far as *A. africana* var. *africana* was concerned, and in a 0.03% yield for *A. africana* var. *ambigua*.

The results of the GC and GC–MS analyses of the five essential oil samples are given in Table 1, where the oil constituents are grouped chemically. It appears from these results that the essential oils of the two varieties of *A. africana* have a similar chemical composition qualitatively. Of all the 36 components identified in these oils, only precocene I (6-demethoxyageratochrome) is not a terpene. However, marked differences were observed in the quantitative composition of the samples even though all the oils contained mainly hydrocarbons. *A. africana* var. *africana* may be affected by the area of plant growth and to some extent by the period of plant collection. The samples from Yaoundé (Y1 and Y2) were rich in monoterpenes (62.7% and 48.4%) with α -pinene (38.7% and 26.5%) as major component; the samples from Bafoussam (B1 and B2) contained mainly sesquiterpenes (88.2% and 94.0%) with germacrene-D (45.0% and 54.2%) as the most abundant one.

The differences observed for the percentage composition of the two samples from Bafoussam could be related to the plant collection periods, since the plants were collected at the same stage of development. The essential oil of *A. africana* var. *ambigua* contained mainly monoterpenes (54.1%) with limonene (23.3%) and α -pinene (21.8%) as major constituents.

Precocene I, an insect antijuvenile hormone, was present in the two plant varieties, constituting up to 5.6% of the total essential oil from the leaves of *A. africana* var. *ambigua*. The occurrence of precocene I in this species is noteworthy since it constitutes a chemotaxonomic marker of the family Asteraceae^{15,16}

and supports the classification of the genus *Aspilia* into the tribe Heliantheae. Eupatorieae are the tribe where the plants accumulate larger amounts of chromenes and benzopyranes.¹⁷

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