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1. Subject and source

The genus *Laggera* Sch. Bip. Ex Benth. & Hook, belongs to the family Asteraceae and contains about 20 species widespread in tropical Africa and Asia (Zheng et al., 2003). Plants of this genus are often used in folk medicine specially for the treatment of jaundice (Mahmoud et al., 1996). Few studies have been carried out regarding the chemistry of *Laggera aurita*. The report published by Zutshi et al. (1975) on the composition of the volatile oil from plant samples harvested in India, revealed the presence of an aromatic ether (2,3-dimethoxy-*p*-cymene). Because the composition of the essential oil from the genus *Laggera* may vary considerably according to the origin of the plant studied (Sohounhloue et al., 2004; Kuiate et al., 2002; Nebie et al., 2002), we present in this report the chemical composition of the volatile oil of *L. aurita* harvested in Burkina-Faso. This work also, emphasises on the chemotaxonomy of species of the genus *Laggera* based on their essential oil composition shown in literature reports.

Plant material was randomly collected from several specimens in September 2000, near the city of Ouagadougou (Burkina-Faso). A voucher specimen is kept at the herbarium of the University of Provence (MAR-2005-01).

2. Previous works

Only two phytochemical studies are available for *L. aurita.* The first study was conducted with specimens from Asia and was a qualitative approach and describes the occurrence of seven constituents in the volatile oil samples (Zutshi et al., 1975). The second report showed that the volatile oil was highly bactericidal (Geda, 1995).

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Table 1
Chemical composition of the essential oil from leaves of *Laggera aurita*

Compound	RI[a]	%RA[b]
Linalool	1098	0.7
cis-p-Menth-2-en-1-ol	1117	0.1
trans-p-Menth-2-en-1-ol	1135	0.1
4-Terpineol	1173	0.6
p-Cymen-8-ol	1182	Tr.[c]
α-Terpineol	1187	0.4
Decanal	1206	0.1
trans-Carveol	1217	Tr.
Nerol	1229	0.1
Thymol methyl ether	1235	0.7
Isothymol methyl ether	1244	0.1
Thymol	1299	Tr.
2,4-Decadienal	1320	Tr.
α-Methyl-3-phenylallyl alcohol	1329	Tr.
Longipinene deriv.	1350	5.0
3-Allylguaiacol	1362	0.2
Longicyclene	1368	0.2
Farnesene deriv.	1373	1.9
6*s*-2,3,8,8-tetramethyltricyclo[5.2.2.01,6]undec-2-ene	1379	1.8
10*s*,11*s*-Himachala-3(12), 4-diene	1399	0.3
Longifolene	1404	0.3
Isocaryophyllene	1405	0.2
β-Caryophyllene	1422	9.6
Dimethoxy-*p*-Cymene	1436	27.7
α-Himachalene	1449	3.0
α-Humulene	1456	6.4
Geranyl acetone	1460	0.1
Alloaromadendrene	1462	0.2
Bicyclo[7.2.0]undec-4-ene, 4,11,11-trimethyl-8-methylene-deriv.	1468	0.3
1H-Benzocycloheptene, 2,4*a*,5,6,9*a*-hexahydro-3,5,5,9-tetramethyl-, deriv.	1478	2.5
Alloaromadendrene	1462	0.2
Bicyclo[7.2.0]undec-4-ene, 4,11,11-trimethyl-8-methylene-deriv.	1468	0.3
1H-Benzocycloheptene, 2,4*a*,5,6,9*a*-hexahydro-3,5,5,9-tetramethyl-, deriv.	1478	2.5
α-Amorphene	1482	0.2
1H-Benzocycloheptene, 2,4*a*,5,6,9*a*-hexahydro-3,5,5,9-tetramethyl-, deriv.	1484	0.6
β-Ionone	1498	0.4
Valencene	1496	0.1
β-Himachalene	1500	0.3
α-Muurolene or its enantiomere: 1ξ,6ξ,7ξ-Cadina-4,9-diene	1502	0.3
γ-Cadinene	1514	0.7
δ-Cadinene	1525	1.2
Elemol	1537	0.6
Caryophyllene oxide deriv.	1549	0.3
Spathulenol	1574	0.2
Caryophyllene oxide	1578	6.1
Humulene epoxide	1602	2.9
Caryophylladienol I	1628	Tr.
T-cadinol	1633	2.4
Cedrene hydrate deriv.	1636	0.5
α-Cadinol	1645	1.7
2,6,9,11-Dodecatetraenal, 2,6,10-trimethyl-	1686	0.5
(±)-Phytone	1827	1.5
Total identified		86.1

[a] Retention index (RI).
[b] Relative area (RA).
[c] Traces.

Table 2
The major constituents of the essential oil of several *Laggera* species from different origins

Species	Location	Main components	RA (%)	Main groups	Reference
Laggera aurita	India	*n*-Heptacosane		Alkane	Zutshi et al. (1975)
		n-Dotriacontane			
		δ-Cadinol		ox sesquiterpene	
		Laggerol			
		m-Menth-6-en-8-ol		ox monoterpene	
		2,3-Dimethoxy-*p*-cymene		Phenolic ether	
	Burkina-Faso	2,5-Dimethoxy-*p*-cymene	27.7	Phenolic ether	Present study
		β-Caryophyllene	9.6	Sesquiterpene hc	
		α-Humulene	6.4		
Laggera alata	Nigeria	2,5-Dimethoxy-*p*-cymene	29.17	Phenolic ether	Ekundayo et al. (1989)
		α-Humulene	14.2	Sesquiterpene hc	
		β-Caryophyllene	10.14		
		2,5-Dimethoxy-*p*-cymene	11.17	Phenolic ether	Ekundayo et al. (1989)
		α-Eudesmol	12.55	ox sesquiterpene	
		2,5-Dimethoxy-*p*-cymene	44	Phenolic ether	Onayade et al. (1990)
		Sabinene	16	Monoterpene hc	
		6-Hydroxycarvotanacetone-7-*O*-angelate	2		
Laggera alata var. *alata*	Comoros	β-Caryophyllene	30.5	Sesquiterpene hc	Said Hassani et al. (2005)
		α-Muurolene	21.1		
		α-Caryophyllene	16.2		
Laggera alata var. *montana*	Cameroun	2,5-Dimethoxy-*p*-cymene	34	Phenolic ether	Kuiate et al. (2002)
		7-*epi*-γ-Eudesmol	21	ox sesquiterpene	
		Juniper camphor	7		
Laggera gracilis	Cameroun	2,5-Dimethoxy-*p*-cymene	33	Phenolic ether	Kuiate et al. (2002)
		γ-Eudesmol	10	ox sesquiterpene	
		β-Caryophyllene	7	Sesquiterpene hc	
Laggera oloptera	Cameroun	β-Caryophyllene	15–20	Sesquiterpene hc	Kuiate et al. (2002)
		Germacrene D	10–17		
		Sabinene	2–28	Monoterpene hc	
	Burkina-Faso	α-Pinene	72.1	Monoterpene hc	Nebie et al. (2002)
		Limonene	14.8		
Laggera pterodonta	Benin	2,5-Dimethoxy-*p*-cymene	30.5	Phenolic ether	Sohounhloue et al. (2004)
		10-*epi*-γ-Eudesmol	24.6	ox sesquiterpene	
		Juniper camphor	7.5		
	Cameroun	2,5-Dimethoxy-*p*-cymene	4–50	Phenolic ether	
		γ-Eudesmol	17–45	ox sesquiterpene	Ngassoum et al. (2000)
		α-Eudesmol	4–15		
		Juniper camphor	4–12		
Laggera tomentosa	Endemic of Ethiopia	Chrysanthenone	58	ox monoterpene	Asfaw et al. (2003)

ox = oxygenated; hc = hydrocarbon.

3. Present study

From dry leaves (200 g), crude essential oil was obtained by hydrodistillation and then analysed by GC–MS (Hewlett-Packard computerized system constituted by a 6890 gas chromatograph coupled to a Hewlett-Packard 5973N quadrupole mass spectrometer) using a HP5MS capillary column (30 m × 0.25 mm × 0.25 μm id). The oven temperature was programmed at 50 °C (initial temperature maintained 2 min) to reach 160 °C at a rate of

2 °C/min, kept constant 5 min, then programmed to reach 270 °C at a rate of 50 °C/min where it remained for 6 min. Carrier gas (Helium 99.95%) was set at a constant flow of 1 ml/min during run. A 2-μl sample volume was injected with automatic injector ALS7683 in a split mode (purge flow set to 50 ml/min after 1 min). Identification was achieved by components mass spectrum comparison to those of personal library, and confirmed by retention indices expected by literature (Adams, 1989; Kuiate et al., 2002).

Hydrodistillation of dry leaves of *L. aurita*, afforded orange oil with a yield of 0.05% (w/w) on dry weight basis. A 1000-fold dilution in hexane of essential oil analysis led to the identification of 52 constituents representing about 86% of the composition of the oil. The relative amounts of the volatile constituents identified are shown in Table 1. The oil is characterized by a high percentage of sesquiterpene hydrocarbons (33%) − β-caryophyllene (9.6%) α-humulene (6.4%) being the major components − and phenolic ethers (28.5%) − the dominant one being dimethoxy-*p*-cymene (27.7%). In the *L. aurita* specimen analysed from India, only seven of the eight constituents separated were identified, namely; *n*-heptacosane, *n*-dotriacontane, laggerol, δ-cadinene, 2,3-dimethoxy-*p*-cymene, α-cadinol and *m*-menth-6-en-8-ol (Zutshi et al., 1975). The sesquiterpene alcohol (laggerol) was not found in our oil samples. C_{27} and C_{32} alkanes could not be detected because of their high molecular weight and GC analysis parameters employed. These variations in the distribution of constituents suggest the existence of two chemical races of *L. aurita*.

4. Chemotaxonomic significance

Several other *Laggera* species have been studied regarding their volatile oil composition (Table 2). Based on the major components characterized from these plants, two chemotaxonomic groups may be established:

Group 1: Species that mainly synthesize the phenol ether dimethoxy-*p*-cymene and sesquiterpenic constituents. This was described from such species as *Laggera pterodonta* (Ngassoum et al., 2000), *L. pterodonta* (Sohounhloue et al., 2004), *Laggera gracilis* (Kuiate et al., 2002), *Laggera alata* (Ekundayo et al., 1989) and *L. alata* var. *montana* (Kuiate et al., 2002) harvested, respectively, from Cameroun, Benin, Cameroun, Nigeria and Cameroun. In this group, we may also include species that major constituents are phenol ethers and monoterpene hydrocarbons as *L. alata* from Nigeria (Ekundayo et al., 1989).

Group 2: Species producing principally either monoterpenes or sesquiterpenes or both classes of terpenic components, except phenyl ether. This is the case for *Laggera tomentosa*, an endemic plant of Ethiopia in which main volatile oil constituents are oxygenated monoterpenes (Asfaw et al., 2003). While *Laggera oloptera* from Burkina-Faso affords mainly monoterpene hydrocarbons (Nebie et al., 2002), both monoterpene and sesquiterpene constituents were shown as the dominant components identified from Cameroun specimens (Kuiate et al., 2002).

On this basis, our *L. aurita* sample from Burkina-Faso may be included in the group n°1 together with *L. gracilis*, *L. alata*, *L. pterodonta* and *L. alata* var. *montana*.

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