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spectra from the literature (3) were also compared.

The volatile compounds identified in the roots of *A. clematidea* from Cuba are tabulated in Table I. Ninety-nine volatile compounds were identified which constituted more than 80% of the total composition (57.5 mg/kg).

The composition of *A. clematidea* was characterized by many sulphur compounds, particularly dimethyl disulfide (35.1% of the total composition) and dimethyl trisulfide (33.2%). Other sulphur compounds were 2,3,5-trithiahexane (tentative) and five other unidentified compounds.

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Comparison of Essential Oil Composition of *Daniellia oliveri* (Rolfe) Hutch et Dalz. (Caesalpinaceae) Leaves from Senegal and Ivory Coast

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Abstract

The comparative analyses of essential oils obtained by hydrodistillation of leaves of *Daniellia oliveri* from Senegal and Ivory Coast were performed by GC and GC/MS. Thirty-six to forty-five components representing 93–95% of the oils were identified in the leaf samples from Senegal and Ivory Coast, respectively. The chemical compositions of both oils were similar. All identified volatile compounds were terpenoids and the major compounds were δ -cadinene (24.2–31.1%) and α -copaene (7.0–8.3%).

Key Word Index

Daniellia oliveri, Caesalpinaceae, essential oil composition, δ -cadinene.

Introduction

Daniellia oliveri (Rolfe) Hutch et Dalz (Caesalpinaceae) is a savanna tree encountered in West Africa (1–3). In Senegal, plant species considered as constructions species such as *Daniellia oliveri* were reported to be declining (4) and it is considered as a species of conservation priority (5). Previous works also present this species as a medicinal plant: antimicrobial properties of leaf alcohol extracts have been reported (6). Bark of this species is also used as mosquito repellent in Guinea Bissau (7). Leaf and bark decoctions are also traditionally used

for anthelmintic purposes (8). A previous study was done on bark essential oil of *D. oliveri* (9). However, to the best of our knowledge, no study reported the leaf oil of this species. Thus, the purpose of this study was to investigate volatile constituents of *D. oliveri* leaves from Senegal and Ivory Coast.

Experimental

Plant material: *Daniellia oliveri* (Rolfe) Hutch et Dalz. leaf samples from trees growing wild were harvested in Senegal in May 1999 near Tambacounda (East of Dakar) and, in Ivory

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Coast, in July 2000 near Adzopé, North of Abidjan. Voucher specimens have been deposited in the Herbarium of the Laboratory "Dynamique et Ressources du Végétal", Equipe Biodiversité et Environnement of the University of Provence.

Sampling was done in the two populations by a collection of leaves from three individuals each.

Isolation of the essential oils: Oil samples were isolated from freshly air-dried at room temperature and powdered leaves, by hydrodistillation for 2 h using a Clevenger-type apparatus (10). Oil yields were then estimated on the basis of the dry weight of plant material. Hydrodistilled mass was 180–270 g of leaves.

Gas chromatography: GC analyses of the oils were performed on a GC (Varian, model 3900GC) with a flame ionization detector (FID), equipped with a CP SIL 8CB fused silica capillary column (30 m × 0.25 mm, 0.25 μm film thickness). Oven temperature was programmed from 50–200°C at 3 °C/min, after an isothermal step at 50°C for 2 min. The carrier gas was H₂, with a flow rate of 0.5 ml/min. Split-splitless injector and detector were heated to 220°C and 230°C, respectively. The injection volume was 0.1 μL for each sample. Essential oil solutions in n-pentane (5%) were injected in split mode (1:30).

Gas chromatography coupled with mass spectrometry: GC/MS analyses were also carried out on a GC/MS Hewlett-Packard (Model 5972) chromatograph equipped with a DB5 fused silica capillary column (25 m × 0.2 mm, film thickness 0.25 μm) coupled with a quadrupole mass spectrometer. Temperature program was 3°C/min from 60–220°C. Split-splitless injector and detector were heated to 220°C and 270°C, respectively. Helium was used as carrier gas at a flow of 1 mL/min. The ionizing energy was 70 eV. All data were collected with a scan time of 0.1 s over a mass range of 38 to 400 daltons.

Identification of components: Individual components were identified by comparison of both mass spectra and GC retention data with those of authentic compounds previously analysed and stored in the data system (computer matching with the NBS 98K and WILEY 275 libraries). Other identifications were made by comparison of mass spectra with those in the data system libraries and cited in the literature (11). The retention indices were calculated for all volatile constituents using an *n*-alkanes homologous series (12).

Results and Discussion

The oil yields varied from 0.45% for the samples from Senegal to 0.65% for those from Ivory Coast. Thirty-six to forty-five components representing 93–95% of the oils were identified in the leaf samples from Senegal and Ivory Coast, respectively (Table I). All identified volatile compounds were terpenoids. Major compounds were δ-cadinene (24.2–31.1%) and other compounds from the same biosynthetic pathway: muurolenes, cadinene-ethers, calacorenes, calamenenes, etc... All these components, characterized by a bicyclo[4,4,0]decane structure, represented 50 % of all the oils. One tricyclo[4,4,0,0]decene was also in representative amount in both oils, *i.e.* α-copaene with 7.0% and 8.3% in the oils from Ivory Coast and Senegal, respectively. Therefore, the composition of both leaf oils was similar. It seems from our limited data that the composition of the leaf oil is typical of the species with no infra-specific variations revealed by the organic volatile compounds composition. This chemical stability was previously illustrated by one of the authors on the

Table I. Chemical composition of the leaf oils of *Daniellia oliveri* from Ivory Coast and Senegal

Compound	RI	Area %	
		Ivory Coast	Senegal
α-cubebene	1347	2.2	1.6
α-copaene ^a	1376	7.0	8.3
β-bourbonene	1381	1.4	1.1
β-cubebene	1389	3.8	4.1
β-elemene ^a	1393	3.8	4.1
cyperene	1399	3.8	4.8
α-gurjunene	1407	0.4	0.1
β-caryophyllene ^a	1417	3.7	3.2
β-copaene	1424	0.4	0.1
α-guaiene	1431	0.1	0.1
β-humulene	1437	0.2	-
α-humulene	1451	3.3	2.9
allo-aromadendrene	1459	3.3	3.1
γ-amorphene	1475	1.2	0.4
γ-muurolene	1479	4.0	4.4
germacrene D	1481	1.0	2.7
β-selinene ^a	1485	1.4	0.8
muurola-4(14),5-diene [*]	1489	0.4	0.1
α-selinene	1495	1.2	0.6
epi-cubebol	1497	0.4	-
α-muurolene	1503	1.4	0.9
germacrene A	1503	-	0.9
γ-cadinene	1505	1.0	-
cis-calamenene	1518	0.1	0.9
cubebol	1521	0.5	-
δ-cadinene	1536	24.2	31.1
cadina-1,4-diene	1539	0.8	0.4
α-calacorene	1543	2.8	2.2
1-norbourbonanone	1550	0.2	-
β-calacorene	1560	1.6	1.9
elemol	1566	0.1	-
cadinene ether [*]	1571	0.9	-
caryophyllene oxide ^a	1578	0.8	2.8
germacrene D-4-ol ^a	1579	3.0	0.8
salvia-4(14)-enone	1586	0.5	0.2
humulenol [*]	1592	0.3	-
humulene oxide II	1604	2.6	1.8
1,10-di-epi-cubenol	1606	0.1	-
fonenol ^{**}	1618	-	3.1
α-cadinol	1640	1.0	-
neo-intermedeol	1652	0.9	1.6
cis-calamenen-10-ol	1655	1.1	1.9
trans-calamenen-10-ol	1665	1.6	1.6
cadalene	1671	0.3	0.6
10-nor-calamenen-10-one	1683	1.0	-
14-oxy-α-muurolene	1696	0.5	-
oplopanone	1731	-	1.0
Total identified		93	95

^{*} Stereochemistry not determined; ^{**} Tentative identification by GC/MS data alone; RI : retention index on DB5 column; ^a also found in *Daniellia ogea* leaf oil, previously reported (13).

volatile composition of *D. oliveri* bark from Benin and Burkina Faso (9). Moreover, *D. oliveri* bark and leaf oil compositions were unexpectedly similar with exclusively terpenoid components and the same major compounds *i.e.* δ-cadinene and α-copaene.

Compared with the composition of the leaf oil of another species from the same genus *i.e.* *D. ogea* (13), only six compounds were found in common. *Daniellia ogea* oil yield (0.05%) was lower than *D. oliveri* oil yields (0.45–0.65%). However, leaf oils of both species were rich in sesquiterpenoids.

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Chemical Composition of the Leaf Oils of *Lippia gracilis* Schauer from two Localities of Pernambuco

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Abstract

The chemical compositions of the essential oils from the leaves collected of *Lippia gracilis* Schauer at two localities in the bioma caatinga of Pernambuco were analyzed by GC and GC/MS, where a total of thirty-six compounds were identified in the oils from all the samples. The chemical profiles of samples from the same locations were the same having only relative changes in composition. But the chemical compositions of oils collected in the vicinity of Buique in the Agreste of Pernambuco were quite different from the ones collected in Ouricuri in the Sertão. The main components identified in samples from Buique were carvacrol (36.4–45.0%) and p-cymene (18.1–26.2%), while thymol (37.4%), γ -terpinene (14.9–20.5%) and 4-methoxy-acetophenone (10.1–12.4%) were the major components found in the specimen collected in Buique.

Key Word Index

Lippia gracilis, Verbenaceae, essential oil composition, carvacrol, thymol acetate, p-cymene, γ -terpinene, 3-methoxy-acetophenone.

Introduction

The state of Pernambuco, located in the Northeast of Brazil, shows 4 phyto-geographic zones: coastal, Atlantic jungle, Savana and Caatinga (1). The last one, even quite modified by anthrop actions, shows a great variety of vegetation types and based on physiognomic aspects, rainfall indices and soil depth, is divided in two subzones called the Agreste and the Sertão (1). The Bioma caatinga is a very characteristic flora of the

Brazilian Northeast which is characterized by herbs, shrubs and small trees very well adapted to the drastic climatic conditions. Besides vegetation having thorns and showing leaf drop, typical for this sub zone, there is also vegetation with trees, mixed with forests of the Serra at mountain tops and slopes higher than 500 m. This relief change can contribute to the genetic variability of the plants, promoting new chemical types growing in different altitudes and regions (2–3). Studies about the chemical composition of the aromatic flora in particularly are

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