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# Chemical Compositions of Aerial Part Essential Oils of *Lantana camara* L. Chemotypes from Madagascar

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**Abstract**

The chemical composition of 12 essential oil samples of the aerial parts of two flower color types of *Lantana camara* from Madagascar collected each month of the year, have been characterized by GC and GC/MS. The main components changed within the two flower color types. The pink-violet flower type contained mainly davanone (23.5%), β-caryophyllene (11.7%), sabinene (10.4%), linalool (5.9%) and α-humulene (4.7%), while the main components of the yellow-orange type were β-caryophyllene (29.8%), β-bisabolene (15.3%), sabinene (13.3%), γ-cadinene (3.7%) and α-humulene (3.1%).

**Key Word Index**

*Lantana camara*, Verbenaceae, davanone, β-caryophyllene, β-bisabolene, sabinene, α-humulene, 1,8-cineole, epi-cubenol, ar-curcumene.

## Plant Name

*Lantana camara* L., native from tropical America, was introduced in Madagascar as an ornamental plant and now is naturalized throughout the highlands and the eastern part of the country.

## Source

Aerial parts of *Lantana camara*, from the yellow-orange and pink-violet flower types growing on the highlands and the eastern part of Madagascar. Herbarum specimens have been deposited at the Museum of Tsimbazaza.

## Plant Part

Leaves and flowers of each flower color type of *L. camara* were collected each month, during one year and steam distilled to give an average yield (vol/wt) of 0.10-0.17%.

## Previous Work

Aerial part, leaf or flower essential oils *L. camara* collected in different countries have been investigated for their chemical composition (1-13) showing large difference percentages for the main compounds, but no studies in relation to flower color types have been investigated.

## Present Work

A Girdel 300 gas chromatograph equipped with a flame ionisation detector (FID) was used for compound separations with a DB-Wax capillary column (30 m x 0.25 mm; phase thickness 0.25 μm; column temperature 60°-240°C at 4°C/min). Detector and inlet temperatures were 250°C. Nitrogen was used as carrier gas with a of flow rate of 20 mL/min. The injections averaged 1 μL of a 2% solution of crude mixtures in pentane. Combined GC/MS was performed on a HP 5890 A gas chromatograph coupled with a HP 5950 mass selective detector (MSD). Separations were done on a HP-5 capillary column (30 m x 0.25 mm; phase thickness 0.25 μm); column temperature, 60°-240°C at 4°C/min). Detector and inlet temperatures were 250°C. Helium was used as carrier gas. Column and temperature conditions were programmed as for analytical analyses. Compounds have been characterized and identified by GC/MS and retention indices (Table I) by comparison with those from MS library (14). Among the 12 oil samples belonging to the pink-violet flower color type the main component was davanone (mean 23.5%) followed by β-caryophyllene

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**Table I. Chemical composition of yellow-orange and pink-violet types of *Lantana camara* oil from Madagascar[a]**

| Component | RI | Yellow-orange | | | Pink-violet | | |
|---|---|---|---|---|---|---|---|
| | | mean | min | max | mean | min | max |
| α-pinene | 1025 | 2.60 | 1.01 | 6.35 | 4.07 | 0.67 | 8.96 |
| camphene | 1063 | 0.71 | 0.00 | 2.19 | 0.64 | 0.00 | 1.78 |
| β-pinene | 1102 | 1.30 | 0.81 | 3.79 | 2.80 | 0.67 | 6.64 |
| sabinene | 1110 | 13.30 | 2.61 | 19.00 | 10.40 | 4.84 | 14.10 |
| δ-3-carene | 1145 | 1.30 | 1.03 | 3.79 | 1.12 | 0.07 | 2.40 |
| myrcene | 1153 | 0.84 | 0.00 | 1.81 | 0.47 | 0.00 | 1.44 |
| α-phellandrene | 1156 | 0.83 | 0.00 | 2.88 | 0.22 | 0.00 | 0.82 |
| limonene | 1200 | 0.70 | 0.08 | 1.66 | 0.77 | 0.00 | 1.87 |
| β-phellandrene | 1205 | 0.63 | 0.11 | 1.06 | 0.74 | 0.00 | 1.75 |
| 1,8-cineole | 1215 | 3.04 | 0.85 | 10.60 | 2.64 | 0.03 | 6.43 |
| γ-terpinene | 1243 | 0.59 | 0.00 | 2.58 | 0.32 | 0.00 | 0.67 |
| (E)-β-ocimene | 1250 | 0.92 | 0.08 | 3.09 | 0.58 | 0.23 | 0.91 |
| p-cymene | 1266 | 0.12 | 0.00 | 0.55 | 0.44 | 0.00 | 1.12 |
| α-cubebene | 1456 | 0.26 | 0.00 | 0.98 | 0.02 | 0.00 | 0.09 |
| δ-elemene | 1467 | 0.96 | 0.49 | 2.16 | 0.67 | 0.32 | 1.12 |
| α-copaene | 1470 | 0.64 | 0.02 | 1.48 | 0.49 | 0.05 | 1.26 |
| camphor | 1512 | 0.48 | 0.23 | 1.44 | 0.79 | 0.50 | 1.39 |
| linalool | 1531 | 1.13 | 0.36 | 2.25 | 5.89 | 2.77 | 7.96 |
| β-elemene | 1590 | 0.21 | 0.25 | 1.44 | 0.08 | 0.03 | 0.16 |
| β-caryophyllene | 1600 | 29.80 | 17.90 | 43.60 | 11.70 | 8.07 | 16.90 |
| aromadendrene | 1607 | 0.87 | 0.02 | 1.69 | 1.36 | 0.61 | 2.23 |
| (E)-β-farnesene | 1662 | 0.09 | 0.00 | 0.74 | 0.28 | 0.00 | 0.60 |
| α-humulene | 1666 | 3.13 | 1.72 | 10.70 | 4.71 | 3.30 | 6.25 |
| γ-muurolene | 1675 | 1.02 | 0.05 | 2.41 | 0.71 | 0.00 | 2.58 |
| α-terpineol | 1684 | 0.58 | 0.21 | 2.46 | 0.91 | 0.22 | 8.70 |
| β-bisabolene | 1730 | 15.30 | 10.40 | 19.70 | 1.91 | 0.40 | 3.21 |
| α-selinene | 1737 | 0.54 | 0.22 | 1.82 | 0.56 | 0.13 | 1.05 |
| germacrene D | 1740 | 2.98 | 0.36 | 5.99 | 3.52 | 1.33 | 5.46 |
| δ-cadinene | 1745 | 2.33 | 0.00 | 3.66 | 1.14 | 0.53 | 1.96 |
| γ-cadinene | 1750 | 3.70 | 0.60 | 7.34 | 0.40 | 0.00 | 0.79 |
| ar-curcumene | 1757 | 2.05 | 0.41 | 8.26 | 2.40 | 0.38 | 12.60 |
| caryophyllene oxide | 1961 | 0.95 | 0.03 | 2.94 | 0.20 | 0.00 | 1.19 |
| (Z)-nerolidol | 2000 | 0.17 | 0.00 | 0.77 | 0.27 | 0.00 | 1.65 |
| davanone | 2008 | 0.09 | 0.00 | 0.42 | 23.50 | 17.80 | 29.20 |
| humulene oxide* | 2012 | 1.86 | 0.03 | 5.95 | 0.28 | 0.07 | 0.74 |
| cubenol | 2017 | 0.13 | 0.00 | 0.51 | 0.20 | 0.00 | 2.15 |
| epi-cubenol | 2019 | 1.25 | 0.00 | 12.00 | 0.39 | 0.06 | 1.70 |
| viridiflorol | 2036 | 0.56 | 0.36 | 1.59 | 0.65 | 0.09 | 2.54 |
| zingiberenol | 2047 | 0.61 | 0.53 | 1.78 | 0.51 | 0.09 | 1.15 |
| spathulenol | 2079 | 1.06 | 0.85 | 4.69 | 0.96 | 0.07 | 2.18 |
| T-cadinol | 2143 | 0.61 | 0.11 | 2.50 | 0.30 | 0.00 | 0.83 |
| α-muurolol | 2150 | 0.63 | 0.00 | 1.86 | 0.36 | 0.00 | 0.99 |
| α-cadinol | 2210 | 0.98 | 0.02 | 3.29 | 0.06 | 0.00 | 0.71 |

[a]relative percentages determined on a DB-Wax column, obtained on 24 essential oils from 12 yellow-orange and 12 pink-violet varieties, collected every month during the year 2003; * correct isomer not identified

(11.7%) and sabinene (10.4%). If the yellow-orange contained a higher amount of β-caryophyllene (29.8%), the occurrence of davanone was quasi nonexistent (only two samples with a mean of 0.09%). In the oils of this last type we noticed higher amounts of other sesquiterpenes such as β-bisabolene (15.3% *vs* 1.9%), γ-cadinene (3.7% *vs* 0.4%) and δ-cadinene (2.3% *vs* 1.1%). The content in linalool was higher in the pink-violet flower color type (5.9%). The sabinene content near 10%, was observed by Ngassoum et al. (8) in the leaves from Cameroon and the leaves and flowers from Madagascar. The α-humulene (3.7-4.7%) was low compared to data from Iran (5).

If davanone was first characterized in *L. camara* from Reunion island (10), its occurrence in *L. camara* oil from Madagascar was described in only two papers (8,12) among the three published (7,8,12). Therefore, we can suppose that the oil investigated by Möllenbeck et al. (7) originated from the yellow-orange type. The range in davanone, obtained in the pink-violet flower colored type (17.8-29.2%) compared to the yellow-orange flowered type clearly indicates the existence of a chemotype rich in this molecule. Analyses done every month and coming from various area of Madagascar show minor changes in chemical composition compared to changes between the two different colored types.

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