

CONSTITUENTS FROM THE STEMS OF *LANTANA CAMARA* (III)

Keh-Feng Huang and Kao-Wei Huang

*Institute of Applied Chemistry, Providence University
Taichung, Taiwan*

(Received 4th February 2004, accepted 26th March 2004)

The known triterpenoids, oleanonic acid (**4**), oleanolic acid (**5**), lantadene A (**6**), lantadene B (**7**), 22 β -angeloyloxylantanollic acid (**8**), lantanilic acid (**9**), betulonic acid (**10**), betulinic acid (**11**) and pomolic acid (**12**), 3 β -hydroxystigmast-5-en-7-one (**3**), β -sitosterol-3-*O*- β -D-glucoside (**2**) as well as a mixture of campesterol (**1a**), stigmasterol (**1b**) and β -sitosterol (**1c**) were isolated from the stems of the yellow flowering taxa of *Lantana camara* L. The structures of these compounds were established by usual spectroscopic methods.

Key words: *Lantana camara* L, Yellow flowering taxa, Triterpenoids, Phytosteroids.

INTRODUCTION

Lantana camara L. (Verbenaceae) is a rambling shrub with a number of flower colors viz. red, pink, white, yellow and violet¹. These plants are cultivated as ornamental or hedge plants in Taiwan². Previously^{3,4}, we reported the phytochemical studies of *Lantana camara* L. and the chemical investigation of the stems from the red flowering taxa and pink flowering taxa of this plant. Herein, we report the isolation of compounds from the stems of another taxa (yellow flower) of this plant, collected at Taichung, Taiwan.

Components **1** - **13** were isolated from the ethyl acetate extract of the stems of this plant as described in the experimental section. Component **1** was identified as a mixture of campesterol (**1a**), stigmasterol (**1b**) and β -sitosterol (**1c**) by spectroscopic method⁴ and GC analysis. Component **2** was identified as β -sitosterol-3-*O*- β -D-glucoside by spectroscopic and chemical methods⁴. In addition, 3 β -hydroxystigmast-5-en-7-one (**3**)⁵, oleanonic acid (**4**)³, oleanolic acid (**5**)³, lantadene A (**6**)³, lantadene B (**7**)³, betulonic acid (**10**)⁴, betulinic acid (**11**)³ and pomolic acid (**12**)³ were also verified by comparing their spectral data with the literature values.

Compound **8**, obtained as colorless needles, mp: 207-209 °C, gave a positive Liebermann-Burchard test and possessed

a molecular ion peak at m/z 568 which was 16 mass units more than **6** by FAB mass spectrometry. The ^1H NMR spectrum of **8** also showed the characteristic signals for a angeloyl moiety at C-22 [1.78 (3H, d, $J = 1.5$ Hz, H-5'), 1.97 (3H, q, $J = 7.3$ Hz, H-4'), 5.99 (1H, qq, $J = 7.3, 1.5$ Hz, H-3') and 5.02 (1H, m, H-22 α)] was similar to that of **6**. Two one-proton doublets appeared at δ 4.20 (1H, d, $J = 11.2$ Hz) and 3.88 (1H, d, $J = 11.2$ Hz) due to two nonequivalent methylene protons (-CH₂-O-C-O-) of hemiketal system. This region of the ^1H NMR spectrum showed a close similarity with that of lantolic acid (3, 25-epoxy-3 α , 22 β -dihydroxy-urs-12-ene-28-oic acid)⁶. Furthermore, the HMBC spectrum of **8** showed the correlations between H-25a (δ 3.88) and C-3 (δ 98.90), H-25b (δ 4.20) and C-3 (δ 98.90), H-25a (δ 3.88) and C-10 (δ 34.99), H-25b (δ 4.20) and C-10 (δ 34.99), H-22 α (δ 5.02) and C-28 (δ 178.96), H-22 α (δ 5.02) and C-1' (δ 166.43). Therefore, the structure of **8** was established as 22 β -angeloyloxylantolic acid by comparison of its spectral data with literature values⁷.

The NMR and MS spectra of compound **9** were similar to those of compound **8** except for the presence of a senecioid moiety at C-22 [1.83 (3H, d, $J = 1.2$ Hz, H-5'), 2.11 (3H, d, $J = 1.2$ Hz, H-4'), 5.55 (1H, m, H-3') and 5.00 (1H, m, H-22 α)] in the ^1H NMR spectrum. Consequently, **9** was identified as lantanilic acid⁸.

The known phytosteroid, 3 β -hydroxystigmast-5-en-7-one (**3**) and known triterpenoids, 22 β -angeloyloxylantolic acid (**8**) and lantanilic acid (**9**) have not previously been obtained from the red flowing taxa³ and pink flowing taxa⁴ of this plant.

This isolation may be applicable to chemotaxonomic studies. This is the first report of the isolation of 3 β -hydroxystigmast-5-en-7-one (**3**) from the genus *Lantana*.

EXPERIMENTAL

Melting points were measured on a Yanaco micro melting point apparatus and are uncorrected. IR spectra were recorded on a HITACHI I-2001 infrared spectrometer. EIMS and FABMS spectra were recorded on a JEOL JMX-SX/SX 102A mass spectrometer. ^1H NMR, ^{13}C NMR, COSY, HMQC, HMBC and DEPT spectra were recorded on Varian VXR-300 or Unity Inova 600 MHz spectrometers with TMS as an internal standard. Optical rotations were measured on a Perkin Elmer 241 MC digital polarimeter.

Plant Material

The stems of *Lantana camara* L. (yellow flower) (Verbenaceae) were collected at Campus of Providence University, Taichung in July 1996. The plant was identified by Mr. Nien-Yung Chiu (Institute of Chinese Pharmaceutical Sciences, China Medical University).

Extraction and Separation

The air-dried stems (8.65 Kg) of *Lantana camara* L. (yellow flower) were extracted with boiling MeOH. The extract was concentrated *in vacuo*. The residue (600 g) was suspended in water and then consecutively

extracted with ethyl acetate and n-butanol. The ethyl acetate fraction (210 g) was chromatographed on a silica gel column using a mixture of CHCl₃-MeOH with increasing solvent polarity as eluent to give three fractions. Fraction I was purified by repeated column chromatography on silica gel eluted with n-hexane-ethyl acetate in order of polarity to afford phytosterols (**1**, 3258 mg), 3 β -hydroxystigmast-5-en-7-one (**3**, 610 mg), oleanonic acid (**4**, 582 mg), betulonic acid (**10**, 320 mg), betulinic acid (**11**, 650 mg) and oleanolic acid (**5**, 2570 mg). Fraction II was further chromatographed on a silica gel column with n-hexane by increasing concentrations of acetone to yield lantadene A (**6**, 720 mg), lantadene B (**7**, 650 mg), 22 β -angeloyloxylantanoic acid (**8**, 720 mg) and lantanilic acid (**9**, 960 mg). Fraction III was rechromatographed on a silica gel column with chloroform and methanol as eluent to give pomolic acid (**12**, 780 mg) and β -sitosterol-3-O- β -D-glucoside (**2**, 3720 mg).

3 β -Hydroxystigmast-5-en-7-one (**3**)

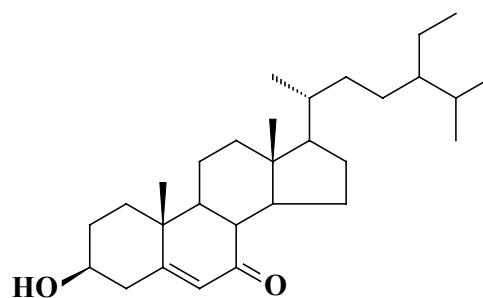
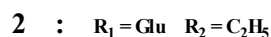
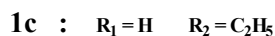
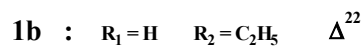
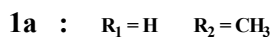
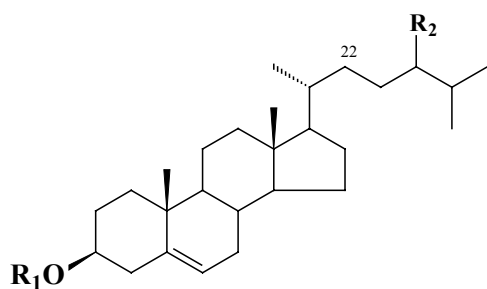
Colorless granules from CHCl₃/MeOH; mp: 127-129 °C; [α]_D: -32.0° (CHCl₃, c = 0.47); L. B. test: positive; IR (KBr) cm⁻¹: 3421 (OH), 1689 (C=O); ¹H-NMR (300 MHz, CDCl₃): δ 0.67 (3H, s, H-18), 1.17 (3H, s, H-19), 3.67 (1H, m, H-3 α), 5.69 (1H, d, *J* = 1.8 Hz, H-6); ¹³C-NMR (75 MHz, CDCl₃): δ 36.28 (t, C-1), 31.16 (t, C-2), 70.52 (d, C-3), 41.78 (t, C-4), 166.10 (s, C-5), 124.01 (d, C-6), 202.85 (s, C-7), 45.56 (d, C-8), 49.93 (d, C-9), 38.36 (s, C-10), 21.20 (t, C-11), 38.81 (t, C-12), 43.08 (s, C-13), 49.93 (d, C-14), 26.54 (t, C-15), 28.11 (t, C-16), 54.48 (d, C-17), 11.94 (q, C-18), 17.30 (q, C-19), 36.07 (d, C-20), 18.91 (q, C-21), 33.93 (t, C-22), 26.35 (t, C-23), 45.87 (d, C-24), 29.69 (d, C-25), 18.76 (q, C-26), 19.79 (q, C-27), 23.03 (t, C-28), 11.94 (q, C-29); EIMS *m/z* (rel. int.): 428 [M]⁺ (100), 410 (20), 395 (32), 287 (18), 247 (10), 192 (30).

22 β -Angeloyloxylantanoic acid (**8**)

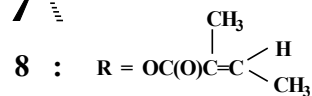
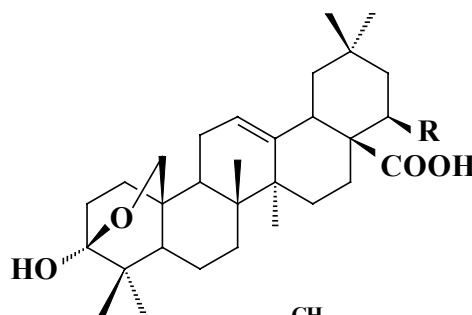
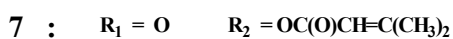
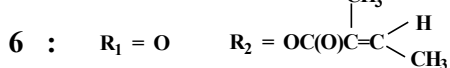
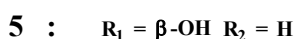
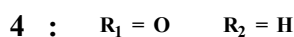
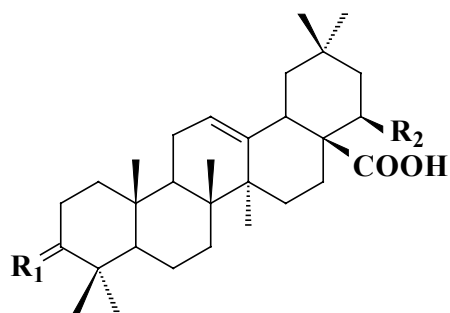
White powders from CHCl₃/MeOH; mp: 207-209 °C; [α]_D: +106.0° (CHCl₃, c = 0.8); L. B. test: positive; IR (KBr) cm⁻¹: 3420 (OH), 1716 (C=O), 1640 (C=C); ¹H NMR (300 MHz, CDCl₃): δ 0.75, 0.85, 0.88, 1.00, 1.02, 1.15 (each 3H, s, CH₃ \times 6), 1.78 (3H, d, *J* = 1.5 Hz, H-5'), 1.97 (3H, q, *J* = 7.3 Hz, H-4'), 3.03 (1H, dd, *J* = 13.7, 4.2 Hz, H-18), 3.88 (1H, d, *J* = 11.2 Hz, H-25a), 4.20 (1H, d, *J* = 11.2 Hz, H-25b), 5.02 (1H, m, H-22 α), 5.37 (1H, m, H-12), 5.99 (1H, qq, *J* = 7.3, 1.5 Hz, H-3'); ¹³C-NMR (75 MHz, CDCl₃-CD₃OD): δ 34.51 (t, C-1), 29.29 (t, C-2), 98.90 (s, C-3), 40.18 (s, C-4), 50.12 (d, C-5), 19.63 (t, C-6), 30.89 (t, C-7), 38.22 (s, C-8), 41.90 (d, C-9), 34.99 (s, C-10), 23.67 (t, C-11), 122.47 (d, C-12), 143.04 (s, C-13), 41.90 (s, C-14), 27.16 (t, C-15), 24.17 (t, C-16), 50.65 (s, C-17), 39.02 (d, C-18), 45.75 (t, C-19), 30.00 (s, C-20), 37.72 (t, C-21), 75.80 (d, C-22), 26.06 (q, C-23), 18.25 (q, C-24), 67.62 (t, C-25), 17.22 (q, C-26), 27.41 (q, C-27), 178.96 (s, C-28), 33.65 (q, C-29), 27.68 (q, C-30), 166.43 (s, C-1'), 127.75 (s, C-2'), 138.42 (d, C-3'), 20.48 (q, C-4'), 15.58 (q, C-5'); Positive ion FABMS (matrix NBA) *m/z* (rel. int.): 569 [M+H]⁺ (40), 468 (80), 451 (50), 423 (40), 154 (NBA + 1, 100).

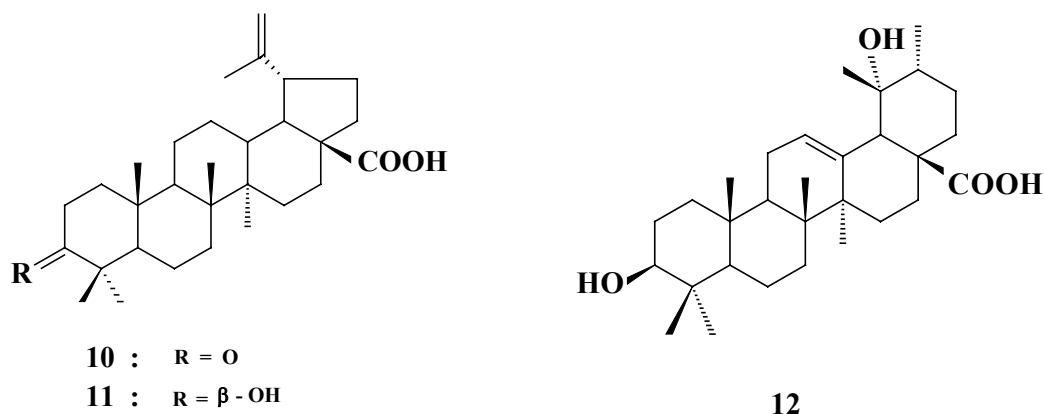
Lantanilic acid (9)

Colorless needles from $\text{CHCl}_3/\text{MeOH}$; mp: 278-280 °C; $[\alpha]_D^{25}$: +179.0° (CHCl_3 , $c = 0.6$); L.B. test: positive; IR (KBr) cm^{-1} : 3482 (OH), 1722 (C=O), 1647 (C=C); $^1\text{H NMR}$ (300 MHz, CDCl_3): δ 0.76, 0.86, 0.94, 0.98, 1.00, 1.13 (each 3H, s, $\text{CH}_3 \times 6$), 1.83 (3H, d, $J = 1.2$ Hz, H-5'), 2.11 (3H, d, $J = 1.2$ Hz, H-4'), 3.02 (1H, dd, $J = 9.2, 4.6$ Hz, H-18), 3.88 (1H, d, $J = 7.8$ Hz, H-25a), 4.21 (1H, d, $J = 7.8$ Hz, H-25b), 5.00 (1H, m, H-22 α), 5.37 (1H, m, H-12), 5.55 (1H, m, H-2'); $^{13}\text{C-NMR}$ (75 MHz, $\text{CDCl}_3\text{-CD}_3\text{OD}$): δ 34.53 (t, C-1), 29.24 (t, C-2), 98.87 (s, C-3), 40.25 (s, C-4), 50.16 (d, C-5), 19.72 (t, C-6), 30.95 (t, C-7), 38.26 (s, C-8), 41.95 (d, C-9), 35.04 (s, C-10), 23.73 (t, C-11), 122.48 (d, C-12), 143.02 (s, C-13), 41.95 (s, C-14), 27.74 (t, C-15), 24.11 (t, C-16), 50.70 (s, C-17), 39.15 (d, C-18), 45.78 (t, C-19), 30.07 (s, C-20), 37.68 (t, C-21), 75.30 (d, C-22), 27.43 (q, C-23), 18.27 (q, C-24), 67.68 (t, C-25), 17.44 (q, C-26), 25.30 (q, C-27), 177.98 (s, C-28), 33.74 (q, C-29), 27.20 (q, C-30), 166.34 (s, C-1'), 115.94 (d, C-2'), 157.10 (s, C-3'), 20.22 (q, C-4'), 26.23 (q, C-5'); Positive ion FABMS (matrix NBA) m/z (rel. int): 569 $[\text{M}+\text{H}]^+$ (45), 468 (76), 451 (45), 423 (35), 154 (NBA + 1, 100).



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ACKNOWLEDGMENTS

The authors are grateful to Mr. Nein-Yung Chiu (China Medicinal University) for identification of the plant materials, Ms. Lih-Mei Sheu (Regional Instruments Center at National Chung-Hsing University) for performing MS measurements and Ms. Mei-Yueh Jean (Regional Instruments Center at National Chung-Hsing University) for performing NMR measurements.

REFERENCES

1. (a) Sharma OP, Makkar HPS, Dawra RK. A Review of the Noxious Plant. *Lantna camara*. *Taxicon*. 26: 975-987, 1988. (b) Ghisalberti EL. *Lantna camara* L. (Verbenaceae). *Fitoterapia*. 71: 467-486, 2000.
2. Cheng YC. *Plants Illustrated for Multiple Usage*, Green Life Magazine Inc. Taipei, p. 280, 1993.
3. Lai JS, Huang JY, Huang KF. Constituents from the Stems of *Lantana camara*. *Chin. Pharm. J.* 48: 451-458, 1996.
4. Lai JS, Chan YF, Huang KF. Constituents from the Stems of *Lantana camara* (II). *Chin. Pharm. J.* 50: 385-392, 1998.
5. Huang KF, Lin FM. Constituents from the Roots of *Elaeagnus glabra*. *Chin. Pharm. J.* 47: 493-500, 1995.
6. Roy S, Barua AK. The Structure and Stereochemistry of a Triterpene Acid from *Lantana camara*, *Phytochemistry*, 24: 1607-1608, 1985.
7. Pan WD, Mai LT, Li YJ, Xu XL, Yu DQ. Studies on the Chemical Constituents of the Leaves of *Lantana camara*, *Acta Pharmaceutia Sinica*, 28: 35-39, 1993.
8. Barre JT, Bowden BF, Coll JC, De Jesus J, De La Fuente VE, Janairo GC, Ragasa CY. A Bioactive Triterpene from *Lantana camara*. *Phytochemistry*, 45: 321-324, 1997.

黃花馬纓丹莖部成分之研究

黃克峯 黃國維

靜宜大學 應用化學研究所

臺中，臺灣

(2004年2月4日受理，2004年3月26日接受刊載)

本研究由黃花馬纓丹 *Lantana camara* Linn. (yellow taxa) 莖部分離得到十二個成分，經光譜分析確定其結構分別為 phytosterols (1), β -sitosterol-3-*O*- β -D-glucoside (2), 3 β -hydroxystigmast-5-en-7-one (3), oleanonic acid (4), oleanolic acid(5), lantadene A (6), lantadene B (7), 22 β -angeloyloxylantanoic acid (8), lantanilic acid (9), betulonic acid (10), betulinic acid (11) 及 pomolic acid (12)。其中 3 β -hydroxystigmast-5-en-7-one (3) 是馬纓丹屬植物文獻上未成報導的成分。

關鍵字：黃花馬纓丹，馬鞭草科，三萜類，固醇類。