Letter

Chemical Constituents from Barks of *Lannea coromandelica*

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**ABSTRACT**

**Objective** To study the chemical constituents from the barks of *Lannea coromandelica*.

**Methods** The chemical constituents were isolated and purified by column chromatography on silica gel column. NMR spectra were used for structural identification. **Results** Thirteen compounds were isolated and identified as quercetin (1), (2S,3S,4R,10E)-2-[(2′R)-2′-hydroxytetrasanooyl amino]-10-octadecene-1,3,4-triol (2), aralia cerebroside (3), 5,5′-dibuthoxy-2,2′-bifuran (4), β-sitosteryl-3β-glucopyranoside-6′-O-palmitate (5), β-sitosterol palmitate (6), myricadiol (7), protocatechuic acid (8), p-hydroxybenzoic acid ethyl ester (9), isovanillin (10), trans-cinnamic acid (11), palmitic acid (12), and stearic acid (13). **Conclusion** Compounds 2–13 are isolated from this plant for the first time.

**Key words** Anacardiaceae; isovanillin; *Lannea coromandelica*; myricadiol; trans-cinnamic acid

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1. **Introduction**

*Lannea coromandelica* (Houtt.) Merr. (Anacardiaceae) is a deciduous tropical tree widely distributed in Bangladesh, India, and some other tropical countries. In China, *L. coromandelica* could be found in Hainan, Yunnan, Guangdong, and Guangxi provinces (South China Research Institute of Plants, Chinese Academy of Sciences, 1964). The bark of *L. coromandelica* is useful in treating cuts, wounds, bruises, ulcers, gastritis, enteritis, leukorrhagia, ophthalmia, gout, ulcerative stomatitis, odontalgia, sprains, diarrhea, and dysentery, and the leaves could be used in treating elephantiasis, inflammation, neuralgia, sprains, and bruises (Islam and Tahara, 2000; Gan et al, 2007). The fruits paste of *L. coromandelica* is therapeutically used for bone fractures by tribes in eastern Ghat of Andhra Pradesh (Venkata and Venkata, 2008). The pharmacological properties of the extract from the stem barks of *L. coromandelica* were screened for anti-inflammatory (Singh and Singh, 2005), hypotensive (Islam et al, 2002), and cytotoxic effects (Rahman et al, 2008). Five dihydroflavonols have been isolated and identified from the stem barks of *L. coromandelica* (Islam and Tahara, 2000).

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To further explore and make good use of this Chinese herbal source, the chemical constituents in the barks of *L. coromandelica* were investigated and compounds 1–13 were isolated. Compounds 2–13 were isolated from this plant for the first time.

2. Materials and methods

2.1 Apparatus and reagents

The NMR spectra were recorded on a Bruker Avance-400 Instrument in deuterated chloroform and acetone with TMS as internal standard. Silica gel (200–300 mesh, Qingdao Marine Chemical, China) and Sephadex LH-20 (Amersham Pharmacia Biotech., Hongkong, China) chromatographies were used for column chromatography. Precoated silica gel GF254 plates and RP-18 F254 plates (0.25 mm, Merck, Germany) were used for TLC.

2.2 Plant material

The barks of *Lannea coromandelica* (Hou. & T. Merr.) were collected in June 2010 from Hainan province, China, and authenticated by Prof. Qiong-xin Zhong, College of Life Science, Hainan Normal University. A voucher specimen (2010060) of *L. coromandelica* was deposited in the Key Laboratory of Tropical Medicinal Plant Chemistry, Ministry of Education, Hainan Normal University, Haikou, China. The material was then air-dried and coarsely powdered.

2.3 Extraction and isolation

The dried powdered stem barks (6.0 kg) of *L. coromandelica* were extracted with 78% ethanol for three times each with petroleum ether, CHCl₃, and EtOAc, respectively. The CHCl₃ extract, upon concentration under reduced pressure, afforded a Blackish green syrup (60.2 g). This syrup was subjected to column chromatography (CC, 100 mesh) on silica gel (0.38 kg) eluting with a petroleum ether–EtOAc gradient (100:0–0:100), yielding 11 fractions (Frs. A–K). Further purification was submitted to silica gel, Sephadex LH-20 chromatography, and preparative TLC. Fr. D yielded compounds 7 (15 mg), 12 (18 mg), and 13 (16 mg). From Fr. F, compound 6 (36 mg) was purified. Fr. I yielded compound 3 (40 mg) and Fr. J yielded compound 10 (13 mg).

The CHCl₃ extract, upon concentration under reduced pressure, afforded a Blackish green syrup (18 g). This syrup was subjected to column chromatography (CC, 100 mesh) on silica gel (0.18 kg) eluting with a petroleum ether–EtOAc gradient (100:0–0:100), yielding 11 fractions (Frs. A–K). Further purification was submitted to silica gel, Sephadex LH-20 chromatography, and preparative TLC. Fr. C yielded compound 4 (12 mg). Fr. G yielded compound 11 (15 mg). From Fr. I, compound 5 (30 mg) was purified.

The EtOAc extract, upon concentration under reduced pressure, afforded reddish brown syrup (33.6 g). This syrup was subjected to CC (100 mesh) on silica gel (0.62 kg) eluting with a petroleum ether–EtOAc gradient (100:0–0:100), yielding Frs. A–K. Further purification was submitted to silica gel, Sephadex LH-20 chromatography, and preparative TLC. Fr. D yielded compound 9 (16 mg). Fr. F yielded compound 8 (17 mg). Fr. G yielded compound 1 (22 mg).

2.4 Discussion

3. Results and discussion

3.1 Structure identification

Compound 1: yellow needles crystal. ¹H-NMR (400 MHz, CDCl₃): δ 7.70 (1H, d, J = 2.0 Hz, H′-2), 7.60 (1H, dd, J = 8.4, 2.0 Hz, H′-6′), 6.90 (1H, d, J = 8.8 Hz, H′-5′), 6.39 (1H, d, J = 2.0 Hz, H-8), 6.18 (1H, d, J = 2.0 Hz, H-6), 1.72 (4H, m, H-7, H-7′). ¹³C-NMR (100 MHz, CDCl₃): δ 175.6 (C′-1′), 131.1 (C-11), 131.0 (C-10), 77.1 (C-3′), 73.3 (C-4′), 72.8 (C′-2′), 62.4 (C-1′), 53.3 (C-2′), 36.0 (C′-3′), 34.4 (C′-5′), 33.6 (C-12), 32.4 (C-9), 29.8-30.6 (C-13′−C-15′), 29.8−30.6 (C-5′−C-2′), 27.0 (C-6′), 26.1 (C′-4′), 23.2 (C-17, C-23′), 14.6 (C-18, C-24). The ¹H-NMR and ¹³C-NMR data were in agreement with those given in literature [Yao et al., 2013; Zhang et al., 2010].

Compound 2: white plate solid. ¹H-NMR (400 MHz, CD₂D₆): δ 8.49 (1H, d, J = 8.8 Hz, N-H), 6.58 (1H, m, H-11), 5.43 (1H, m, H-10), 5.02 (1H, dd, J = 9.2, 4.8 Hz, H-2′), 4.54 (1H, dd, J = 7.6, 3.6 Hz, H-2′), 4.42 (1H, dd, J = 10.6, 4.6 Hz, H-1a), 4.33 (1H, dd, J = 10.8, 5.2 Hz, H-1b′), 4.27 (1H, m, H-3′), 4.19 (1H, m, H-4′). ¹³C-NMR (100 MHz, CD₂D₆): δ 175.6 (C-1′), 131.1 (C-11′), 131.0 (C-10′), 77.1 (C-3′), 73.3 (C-4′), 72.8 (C′-2′), 62.4 (C-1′), 53.3 (C-2′), 36.0 (C′-3′), 34.4 (C′-5′), 33.6 (C-12′), 32.4 (C-9′), 29.8-30.6 (C′-13′−C-16′), 29.8−30.6 (C-5′−C-2′), 27.0 (C-6′), 26.1 (C′-4′), 23.2 (C-17, C-23′), 14.6 (C-18, C-24′). The ¹H-NMR and ¹³C-NMR data were in agreement with those given in literature [Zhan et al., 2003], and compound 2 was identified as aralidione. A new compound was identified as 

Compound 3: white powder. ¹H-NMR (400 MHz, CDCl₃): δ 8.50 (1H, d, N-H), 5.82 (2H, H-8, H-9), 5.43 (1H, H-2′), 4.96 (1H, H-1′), 4.53, 4.41, 4.34, 4.27, 4.20 (5H, H-1a, H-2, H-1b, H-3, H-4), 0.77 (6H, 2CH₃). ¹³C-NMR (100 MHz, CDCl₃): δ 175.0 (C′-1′), 130.6 (C-8′), 130.5 (C-9′), 107.2 (C-1′″), 76.6 (C-3′″), 76.5 (C-3), 76.5 (C-2′″), 72.8 (C-2′), 72.7 (C-4′′), 72.2 (C-1′″), 61.8 (C-6′″), 52.7 (C-2′″), 35.5 (C-3′″), 33.9 (C-5′″), 33.6 (C-10″), 32.8 (C-7″), 26.4 (C-6″), 22.7−33.1 (C-11″−C-17, C′-4″−C′-15″), 14.1 (C-18, C-16″). The ¹H-NMR and ¹³C-NMR data were in agreement with those given in literature [Liu and Yang, 2008], and compound 3 was identified as aralia cerebroside.

Compound 4: pale yellow amorphous powder. ¹H-NMR (400 MHz, CDCl₃): δ 7.72 (2H, dd, J = 6.4, 3.2 Hz, H-3, H-3′), 7.53 (2H, dd, J = 6.4, 3.2 Hz, H-4, H-4′), 4.30 (4H, t, J = 6.8 Hz, H-6, H-6′), 1.72 (4H, m, H-7, H-7′), 1.44 (4H, m, H-8, H-8′).
29.77 (C-7), 29.4 (C-7′), 29.39 (C-13), 29.3 (C-10), 29.0 (C-22), 28.7 (C-23), 28.0 (C-2), 26.2 (C-27), 21.5 (C-30), 19.2 (C-6), 17.8 (C-11), 16.4 (C-5). The \( ^{1}H\)-NMR and \( ^{13}C\)-NMR data were in agreement with those given in literature (Sakurai et al., 1986), and compound 4 was identified as \( \beta \)-sitosterol palmitate.

Compound 5: colorless needles crystal. \( ^{1}H\)-NMR (400 MHz, \( CD_{2}D_{2}N \)) \( \delta \): 0.56, 0.84 (3H each, s, CH\( _{3}\)-18, CH\( _{3}\)-19), 0.89 (3H, d, \( J = 6.4 \) Hz, CH\( _{2}\)-21), 0.76, 0.77, 0.79, 0.82 (3H each, CH\( _{2}\)-26, CH\( _{2}\)-27, CH\( _{2}\)-29, CH\( _{2}\)-16); \( ^{13}C\)-NMR (100 MHz, \( CD_{2}D_{2}N \)) \( \delta \): 175.4 (-COOH), 151.5 (C-4), 146.0 (C-3), 123.9 (C-6), 78.2 (C-3), 62.2 (C-28), 56.0 (C-14), 56.1 (C-17), 50.2 (C-9), 45.9 (C-24), 42.3 (C-4, C-13), 39.8 (C-12), 37.3 (C-1), 36.5 (C-10), 36.2 (C-20), 34.1 (C-2′), 34.0 (C-22), 32.0 (C-7), 31.9 (C-8, C-14′), 31.7 (C-2), 29.7 (C-10′, C-11′, C-12′, C-13′), 29.6 (C-9′), 29.5 (C-8′), 29.4 (C-7′), 29.3 (C-6′), 29.2 (C-25, C-4′, C-5′), 28.3 (C-16), 26.1 (C-23), 24.9 (C-3′), 24.3 (C-15), 23.1 (C-28), 22.7 (C-15′), 21.1 (C-11), 19.8 (C-26), 19.4 (C-19), 19.1 (C-27), 18.8 (C-21), 14.1 (C-16′), 12.0 (C-29), 11.9 (C-18). The \( ^{1}H\)-NMR and \( ^{13}C\)-NMR data were in agreement with those given in literature (Sun et al., 2002), and compound 6 was identified as \( \beta \)-sitosterol palmitate.

Compound 7: white amorphous powder. \( ^{1}H\)-NMR (400 MHz, \( CD_{2}D_{2}N \)) \( \delta \): 0.81, 0.87, 0.90, 0.90, 0.92, 0.98, 1.03 (3H each, 21H, s), 3.34 (1H, dd, \( J = 10.2, 5.8 \) Hz, H-3), 5.53 (1H, dd, \( J = 7.8, 3.0 \) Hz, H-15); \( ^{13}C\)-NMR (100 MHz, \( CD_{2}D_{2}N \)) \( \delta \): 158.5 (C-14), 117.1 (C-15), 78.2 (C-3), 62.2 (C-28), 56.0 (C-5), 49.6 (C-18), 49.2 (C-9), 41.7 (C-19), 39.4 (C-4), 39.3 (C-8), 38.3 (C-13, C-17), 38.0 (C-10), 37.8 (C-1), 36.9 (C-7′), 34.0 (C-29), 33.8 (C-21), 33.4 (C-16′), 32.1 (C-12), 30.0 (C-26), 29.6 (C-20), 29.0 (C-22), 28.7 (C-23), 28.0 (C-2), 26.2 (C-27), 21.5 (C-30), 19.2 (C-6), 17.8 (C-11), 16.4 (C-5), 15.7 (C-25). The \( ^{1}H\)-NMR and \( ^{13}C\)-NMR data were in agreement with those given in literature (Sakurai et al., 1986), and compound 7 was identified as myricadiol.

Compound 8: colorless needles crystal. \( ^{1}H\)-NMR (400 MHz, \( CD_{3}OD \)) \( \delta \): 7.41 (1H, d, \( J = 2.0 \) Hz, H-2), 6.80 (1H, d, \( J = 8.0 \) Hz, H-5), 7.44 (1H, s, H-6); \( ^{13}C\)-NMR (100 MHz, \( CD_{3}OD \)) \( \delta \): 170.4 (-COOH), 151.5 (C-4), 146.0 (C-3), 123.9 (C-6), 123.2 (C-1), 117.8 (C-2), 115.8 (C-5). The \( ^{1}H\)-NMR and
\(^{13}\)C-NMR data were in agreement with those given in literature (Wu et al., 1999), and compound 8 was identified as protocatechuic acid.

Compound 9: white crystal. \(^{1}H\)-NMR (400 MHz, CD\(_2\)COCD\(_3\)): \(\delta\): 9.17 (1H, s), 7.95 (2H, d, J = 8.4 Hz, H-3, 5), 6.97 (2H, d, J = 8.8 Hz, H-2, 6), 4.31 (2H, q, J = 7.2 Hz), 1.34 (3H, t, J = 7.0 Hz). \(^{13}\)C-NMR (100 MHz, CD\(_2\)COCD\(_3\)): \(\delta\): 167.1 (−C=O), 162.8 (C-4), 132.7 (C-2, C-6), 122.9 (C-1), 116.3 (C-3, C-5), 61.3 (−OCH\(_2\)), 15.0 (−CH\(_3\)). The \(^{1}H\)-NMR and \(^{13}\)C-NMR data were in agreement with those given in literature (Wang et al., 2003; Amiram et al., 1997; Kapche et al., 2007).

In addition, it should be noted that ceramide (compound 2) and glycosphingolipid (compound 3) have not so far been reported to occur in other species of *Lannea* A. Rich., nor in other genera of the Anacardiaceae, and could serve as the chemosystematic marker for *L. coromandalica*.

The above information may give some chemotaxonomic support for the treatment of the investigated species as *L. coromandalica*.

### References


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**Latest Progress on *Chinese Herbal Medicines***

Since the foundation of Chinese Herbal Medicines (CHM) in 2009, it has been included in China Academic Journals Integrated Online Database, Chemical Abstracts Service (CAS) in USA, Index of Copernicus (IC) in Poland, Ulrich’s Periodicals Directory (UPD) in USA, Centre for Agriculture and Bioscience International Abstracts (CABI), Global Health (GH), and EMBASE in Holland.

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