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Chemical Constituents of *Ixora philippinensis* Merr.

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ABSTRACT

Chemical investigations of the dichloromethane extracts of *Ixora philippinensis* Merr., a plant endemic to the Philippines, led to the isolation of syringaresinol (**1**), pinoresinol (**2**), isoscopoletin (**3**), squalene (**4**), β-sitosterol (**5a**), and stigmasterol (**5b**) from the stems; and **4**, **5a**, **5b**, lupeol (**6**), and lutein (**7**) from the leaves. The structures of **1** and **3** were elucidated by extensive 1D and 2D NMR spectroscopy, while those of **2** and **4**-**7** were identified by comparison of their NMR data with literature data.

INTRODUCTION

Ixora philippinensis, a Philippine endemic ornamental plant, is locally known as white santan (Merril, 1910). The fruits of *I. philippinensis* are edible (Ysrael and Valkenburg, 1999). There are no reported studies on the chemical constituents and biological activities of *I. philippinensis*. However, a number of studies have been reported on a congener of the plant, *Ixora coccinea* L. which is cultivated throughout the Philippines as an ornamental plant. The flowers of this plant are used in the treatment of dysentery and leucorrhoea. A decoction of the flowers is used for the treatment of haemoptysis and catarrhal bronchitis (Quisumbing, 1978). Cytotoxic and antitumor principles (Latha and Panikar, 1998), chemoprotective (Latha and Panikar, 2001) and modulatory effects (Latha and Panikar, 1999) of the flowers on cisplatin-induced toxicity in mice have been reported. *I. coccinea* flowers yielded ursolic acid which was reported to be anti-genotoxic (Latha *et al.*, 2001). 21,23-Epoxy-tirucall-7-en-3β-ol also known as ixoroid, stigmast-5-en-3-O-β-D-glucoside, 5-O-caffeoylquinic acid and D-mannitol were isolated from the flowers of *I. coccinea* (Vesiani *et al.*, 2012). The flowers of *I. coccinea* contain rutin, leucocyanadin glycoside, cyanadin-3-rutinoside and delphinidin monoglycoside, while the root contains octadecadienoic acid and methyl esters of palmatic, oleic, stearic and linolic acid (Kharat *et al*., 2013; Elumalai and Chinna, 2012). Lupeol isolated from the leaves of the plant showed anti-inflammatory and anti-mitotic activities (Reena *et al.*, 1994). The major constituents of *I. coccinea* were reported to be lupeol, oleic acid, linolic acid, ursolic acid, oleanolic acid, stearic acid and β-sitosterol. A new triterpene, 17β-dammara-12,20-diene-3β-ol also known as ixorene was isolated from the leaves of *I. coccinea*, together with β-sitosterol, lupeol and D-mannitol (Ikram *et al.*, 2013). The methanol extract of the leaves of *I. coccinea* yielded ixoratannin A-2, epicatechin, procyanidin A2, cinnamtannin B-1, kaempferol-7-O-α-L-rhamnoside, kaempferol-3-O-α-L-rhamnoside, quercetin-3-O-α-L-rhamnopyranoside, and kaempferol-3,7-O-α-L-dirhamnoside (Idowu *et al.*, 2010). *I. coccinea* leaves afforded quercetin which exhibited high antioxidant activity (Bose *et al.*, 2013). The major constituents of *I. coccinea* root were identified by GC-MS as hexadecanoic acid (7.38%), 9-octadecenoic acid methyl ester (1.97%), 2,6-dimethoxyphenol (1.35%), 13-docosenamide (1.31%), 3,4,5-trimethoxyphenol (1.24%), and 4,8,12,16-tetramethy lheptadecan-4-olide (1.13%) (Ghazali*et al.*, 2014).

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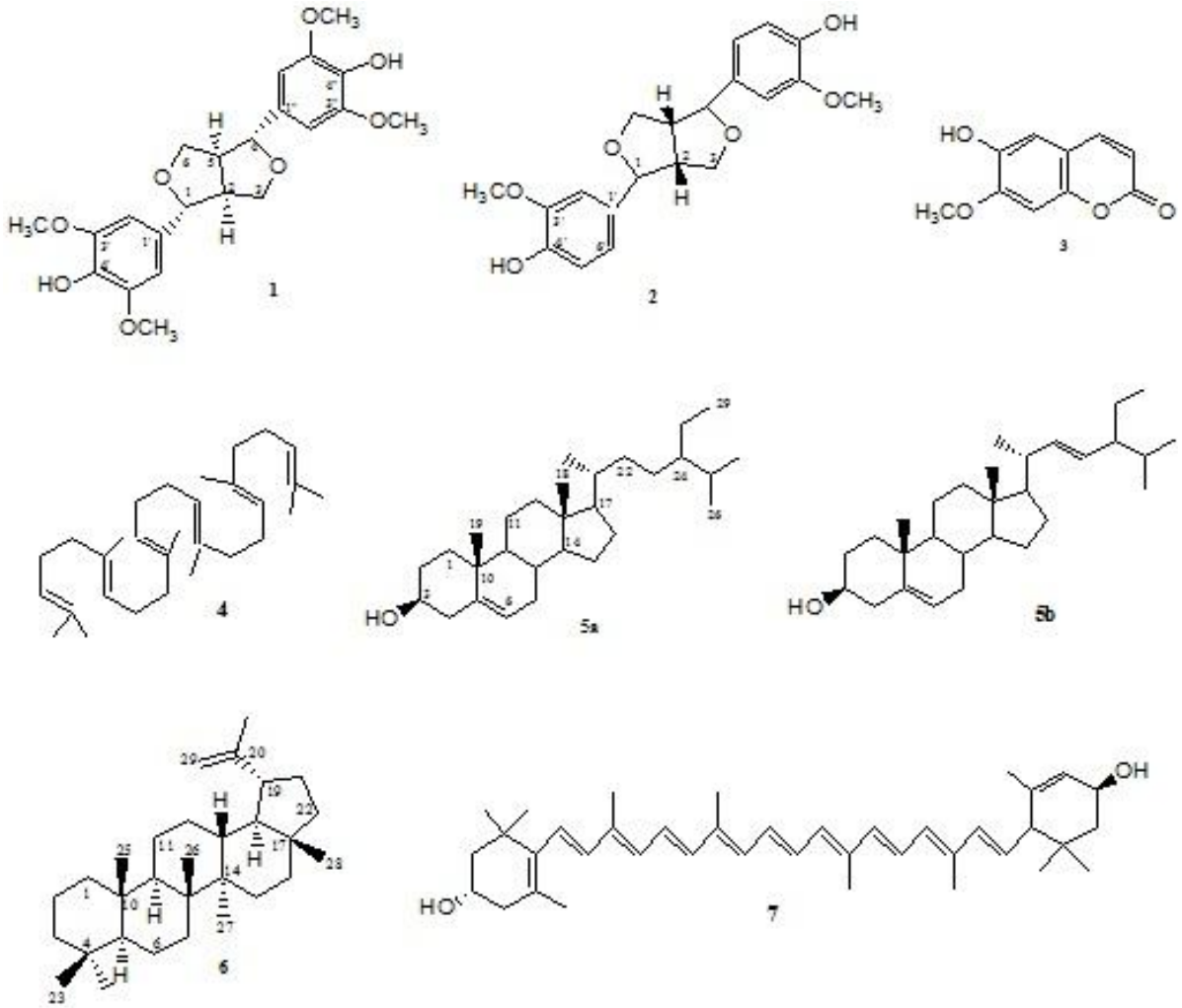

Chemical structures of syringaresinol (**1**), pinoresinol (**2**), isoscopoletin (**3**), squalene (**4**), β-sitosterol (**5a**), stigmasterol (**5b**), lupeol (**6**), and lutein (**7**).

The roots also yielded 9,12-octadecadienoic acid, di-n-octyl phthalate, β-amyrin, kaempferol-7-O-glucoside, kaempferitrin and quercitrin (Joshi *et al.*, 2013). The main sesquiterpenes identified from the root oil of *I. coccinea* were β-sesquiphellandrene (17.83%), ar-curcumene (2.77%), E-α-bergamotene (2.07%), α-zingiberene (1.92%), caryophyllene oxide (1.88%) and δ-nerolidol (1.44%) (Srinivasan *et al.*, 2010). Another ornamental plant is *Ixora chinensis* which is found throughout the Philippines. An infusion of fresh flowers of *I. chinensis* is used for the treatment of tuberculosis, hemorrhage and headache, while flower decoction is employed for amenorrhea and hypertension (Khare, 2007). *I. chinensis* yielded D-mannitol, stearic acid, 1,5-cyclooctadiene, β-sitosterol, (10E)-9-oxooctadec-10-en-12-ynoic acid, azelaic acid, and dihydromasticadienolic acid (Ren *et al.*, 2012). The mature seeds of *I. chinensis* afforded an oil having fatty acid composition like palmitic, stearic, oleic, linoleic, crepenynic and ixoric acid (Faten and Zedan, 2003). The leaves and twigs of *I. chinensis* yielded new iridoid glucosides, ixoroside and ixoside (7,8-dehydroforsythide) and geniposidic acid (Takeda *et al.*, 1975).

A study on another species of *Ixora*, *I. parviflora* reported that the flowers are used in the treatment of whooping cough and ulcers (Bachheti and Pandey, 2011). The chloroform extract of *I. parviflora* yielded β-sitosterol, kaempferol, β-sitosterol-β-D-glycoside, kaempferol-7-O-methyl ether (Bachheti and Pandey, 2011). The alcoholic extract of the flowers of *I. parviflora* Vahl afforded chlorogenic acid, apigenin, quercetin, apigenin-7-O-β-D-glucopyranoside, and quercetin-3-O-β-D-galactopyranoside (Gonaid and Sleem, 2006). *I. parviflora* seed oil was found to contain the following acids: capric (1.3%), lauric (3.1%), myristic (4.7%), palmitic (11.4%), stearic (11.9%), arachidic (2.9%), behenic (2.0%), oleic (18.7%), and linoleic (44.0%) (Dalatabad and Ankalagi, 1982).

The leaves of another *Ixora* species, *I. undulata* yielded 1-(R)-phenylethanol β-gentiobioside, 2-methyl-phenylmethanol β-gentiobioside, 3,4-dimethylphenol β-gentiobioside, (5R,6R,Z)-5,6-dihydroxy-5,6-dihydro-2H-thiopyran-2-oneO-methyloxime β-D-glucopyranoside, (5R,6R,Z)-5,6-dihydroxy-5,6-dihydro-2H-thiopyran-2-one O-methyl oxime β-gentiobioside, kaempferol 3-O-α-L-rhamnopyranosyl-(1→6)-(4"-trans-p-coumaroyl)-β-D-

galactopyranoside, icariside B, 7-O-α-L-rhamnopyranoside, corchoionoside C, 3-methoxy-4-hydroxyphenol 1-O-β-D-glucopyranoside, kaempferol 3-O-robinobioside, quercetin 3-O-robinobioside, variabiloside E, and acteoside. Corchoionoside C, quercetin 3-O-robinobioside and variabiloside E showed strong inhibitory activity toward advanced glycation end-products formation with IC_{50} values of 86.0 μM, 76.6 μM, and 98.6 μM, respectively (Sugimoto *et al.,* 2014). Furthermore, the leaves of *I. undulata* Roxb. afforded 7-[(β-D-glucopyranosyl)oxy]-6-hydroxy-2-methoxy-6,7-dihydro-1,3-thiazepine, an alkaloid also known as rubiothiazepine which showed cytotoxic activity against EL4 (Murine Leukemia, IC_{50}>100 μg/mL), cytotoxic and HIV-1 activity against MT-4 and HIV-1IIIB with CC_{50}>100 μg/mL and EC_{50}>100 μg/mL, respectively (Mohammed *et al*., 2014).

Other *Ixora* species have been studied for their chemical constituents. The stems of *I. amplexicaulis* afforded 6α,16α-dihyroxy-ent-kaurane, (24R)-6β-hydroxy-24-ethyl-cholest-4-en-3-one, 7β-hydroxysitosterol, maslinic acid, 3,3'-bis(3,4-dihydro-4-hydroxy-6-methoxy-2H-1-benzopyran) and protocatechuric acid (Chen *et al.,* 2015). Furthermore, the purified fractions of *I. javanica* flowers that showed antitumor properties contained ferulic acid, pyrocatacheuic acid and caffeic acid (Nair and Panikkar, 1990). Another study reported the isolation of 3-butyn-2-ol, 3-butyn-1-ol, amyl nitrite, 2-octyn-1-ol, 1,9-decadiyne and buglyoxylate from *I. pavetta* Vahl. (Srinivas, K.; Celestin Baboo, 2011). Moreover, the isolation of 3-O-β-D-glucopyranosyl-2α, 19α-dihydroxyurs-12-en-28-oic acid β-D-glucopyranosyl ester and 2α,3β,19α-trihydroxyurs-12-en-28-oic acid β-D-galactopyranosyl ester from the leaves of *I. finlaysoniana* have been reported (Chauhan *et al.,* 2006). A new flavone glycoside isolated from the stem of *I. arborea* was characterized as chrysin 5-O-β-D-xylopyranoside (Chauhan *et al.,* 1984), while another study reported the isolation of apigenin-5-O-β-D-galactopyranoside (Chauhan *et al.,* 1982). Reviews on the phytochemical and pharmacological activity of genus *Ixora* have been provided (Kharat*et al*., 2013; Jiang *et al.,* 2013). This study is part of our research on the chemical constituents of the genus *Ixora* found in the Philippines. We earlier reported the isolation of two new cycloartenol esters, lupeol fatty ester, lupeol, ursolic acid, oleanolic acid, and β-sitosterol from the air-dried flowers of *I. coccinea* (Ragasa *et al*., 2004). We report herein the isolation of syringaresinol (**1**) pinoresinol (**2**), isoscopoletin (**3**), squalene (**4**), β-sitosterol (**5a**), and stigmasterol (**5b**) from the stems; and **4**, **5a**, **5b**, lupeol (**6**), and lutein (**7**) from the leaves of *Ixora philippinensis*. To the best of our knowledge this is the first report on the isolation of these compounds from *I. philippinensis*.

MATERIALS AND METHODS

General Experimental Procedure

NMR spectra were recorded on a Varian VNMRS spectrometer in $CDCl_3$ at 600 MHz for ^1H NMR and 150 MHz for ^{13}C NMR spectra. Column chromatography was performed with silica gel 60 (70-230 mesh). Thin layer chromatography was performed with plastic backed plates coated with silica gel F_{254} and the plates were visualized by spraying with vanillin/H_2SO_4 solution followed by warming.

General Isolation Procedure

A glass column 20 inches in height and 2.0 inches internal diameter was packed with silica gel. The crude extract from the leaves were fractionated by silica gel chromatography using increasing proportions of acetone in CH_2Cl_2 (10% increment) as eluents. One hundred milliliter fractions were collected. All fractions were monitored by thin layer chromatography. Fractions with spots of the same R_f values were combined and rechromatographed in appropriate solvent systems until TLC pure isolates were obtained. A glass column 12 inches in height and 0.5 inch internal diameter was used for the rechromatography. Five milliliter fractions were collected. Final purifications were conducted using Pasteur pipettes as columns. One milliliter fractions were collected.

Sample Collection

The sample was collected from Bataan, Philippines in October 2013. It was identified as *Ixora philippinensis* Merr. at the Jose Vera Santos Herbarium, Institute of Biology, University of the Philippines, Diliman, Quezon City.

Isolation of the Chemical Constituents of the Stems

The air-dried stems (218 g) of *I. philippinensis* were ground in an osterizer, soaked in CH_2Cl_2 for three days, and then filtered. The filtrate was concentrated under vacuum to afford a crude extract (3.1 g) which was chromatographed using increasing proportions of acetone in CH_2Cl_2 (10% increment) as eluents. The CH_2Cl_2 fraction was rechromatographed (3 ×) in 1% EtOAc in petroleum ether to afford **4** (12 mg). The 30% acetone in CH_2Cl_2 fraction was rechromatographed (2 ×) in 15% EtOAc in petroleum ether to afford a mixture of **5a** and **5b** (2 mg) after washing with petroleum ether. The 50% acetone in CH_2Cl_2 fraction was rechromatographed (3 ×) using CH_3CN:Et_2O:CH_2Cl_2 (1:1:8 by volume ratio) to afford **3** (1 mg) after trituration with petroleum ether. The 60% acetone in CH_2Cl_2 fraction was rechromatographed (3 ×) using CH_3CN:Et_2O:CH_2Cl_2 (1.5:1.5:7 by volume ratio) to afford **2** (3 mg) after trituration with petroleum ether. The 70% acetone in CH_2Cl_2 fraction was rechromatographed (4 ×) using CH_3CN:Et_2O:CH_2Cl_2 (1.5:1.5:7 by volume ratio) to afford **1** (3 mg) after trituration with petroleum ether.

Isolation of the Chemical Constituents of the Leaves

The air-dried leaves (605 g) of *I. philippinensis* were ground in an osterizer, soaked in CH_2Cl_2 for three days, and then filtered. The filtrate was concentrated under vacuum to afford a crude extract (18.2 g) which was chromatographed using increasing proportions of acetone in CH_2Cl_2 (10% increment) as

eluents. The CH_2Cl_2 fraction was rechromatographed (3 ×) in 1% EtOAc in petroleum ether to afford **4** (18 mg). The 30% acetone in CH_2Cl_2 fraction was rechromatographed (4 ×) in 15% EtOAc in petroleum ether to afford **6** (3 mg) after washing with petroleum ether. The 40% acetone in CH_2Cl_2 fraction was rechromatographed (2 ×) in 20% EtOAc in petroleum ether to afford a mixture of **5a** and **5b** (4 mg) after washing with petroleum ether. The 50% acetone in CH_2Cl_2 fraction was rechromatographed (3 ×) in CH_3CN:Et_2O:CH_2Cl_2 (0.5:0.5:9, v/v) to yield **7** (7 mg) after washing with petroleum ether, followed by Et_2O.

***Syringaresinol* (1)**

^{1}H NMR (600 MHz, $CDCl_3$): δ 3.07 (m, H-2, H-5), 4.71 (d, *J* = 4.2 Hz, H-1, H-4), 4.26 (dd, *J* = 9, 4.2 Hz, H-3a, H-6a), 3.89 (dd, *J* = 6.6, 4.2 Hz, H-3b, H-6b), 6.56 (s, H-2', H-6', H-2", H-6"), 3.89 (s, 3'-OCH_3, 5'-OCH_3, 3"-OCH_3, 5"-OCH_3), 5.57 (s, 4'-OH, 4"-OH); ^{13}C NMR (150 MHz, $CDCl_3$): δ 86.07 (C-1, C-4), 54.35 (C-2, C-5), 71.80 (C-3, C-6), 132.08 (C-1', C-1"), 102.65 (C-2', C-6', C-2", C-6"), 147.14 (C-3', C-5', C-3", C-5"), 134.26 (C-4', C-4"), 56.37 (3'-OCH_3, 5'-OCH_3, 3"-OCH_3, 5"-OCH_3).

***Pinoresinol* (2)**

^{1}H NMR (600 MHz, $CDCl_3$): δ 4.72 (d, *J* = 4.2 Hz, H-1, H-4), 3.08 (1H, m, H-2, H-5), 3.86 (dd, *J* = 3.6, 9.0 Hz, H-3b, H-6b), 4.25 (dd, *J* = 7.2, 9.0 Hz, H-3a, H-6a), 6.88 (d, *J* = 1.8 Hz, H-2', H-2"), 6.87 (d, *J* = 7.8 Hz, H-5', H-5"), 6.82 (dd, *J* = 8.4, 1.8 Hz, H-6', H-6"), 3.93 (s, 3'-OCH_3, 3"-OCH_3); ^{13}C NMR (150 MHz, $CDCl_3$): δ 85.86 (C-1, C-4), 54.15 (C-2, C-5), 71.66 (C-3, C-6), 132.90 (C-1', C-1"), 108.56 (C-2', C-2"), 146.68 (C-3', C-3"), 145.22 (C-4', C-4"), 114.24 (C-5', C-5"), 118.96 (C-6', C-6"), 55.95 (3'-OCH_3, 3"-OCH_3).

***Isoscopoletin* (3)**

^{1}H NMR (600 MHz, $CDCl_3$): δ 6.25 (d, *J* = 9.0 Hz, H-3), 7.57 (d, *J* = 9.0 Hz, H-4), 6.83 (brs, H-5), 6.90 (brs, H-8), 6.09 (brs, -OH), 3.94 (s, -OCH_3). ^{13}C NMR (150 MHz, $CDCl_3$): δ 161.43 (C-2), 111.49 (C-3), 143.26 (C-4), 107.42 (C-5), 149.65 (C-6), 143.96 (C-7), 103.19 (C-8), 150.26 (C-9), 113.45 (C-10), 56.40 (-OCH_3).

***Squalene* (4)**

^{1}H NMR (600 MHz, $CDCl_3$): δ 5.07-5.13 (6H, = CH), 1.58 (18H, allylic CH_3, *cis*), 1.66 (6H, allylic CH_3, *trans*), 1.94-2.08 (20H, allylic CH_2). ^{13}C NMR (150 MHz, $CDCl_3$): δ 25.69 (C-1), 131.26 (C-2), 124.27 (C-3), 26.66 (C-4), 39.75 (C-5), 134.90 (C-6), 124.30 (C-7), 26.76 (C-8), 39.72 (C-9), 135.10 (C-10), 124.40 (C-11), 28.27 (C-12), 17.67 (C-2′), 16.04 (C-6′), 15.99 (C-10′).

***β-Sitosterol* (5a)**

^{1}H NMR (600 MHz, $CDCl_3$): δ 3.50 (m, H-3), 2.26, 2.21 (H_2-4), 5.33 (dd, *J* = 5.0, 2.0 Hz, H-6),0.66 (s, CH_3-18), 0.99 (s, CH_3-19), 0.90 (d, *J* = 7.0 Hz, CH_3-21), 0.79 (d, *J* = 7.0 Hz, CH_3-26), 0.82 (d, *J* = 7.0 Hz, CH_3-27), 0.85 (t, *J* = 7.0 Hz, CH_3-29). ^{13}C NMR (150 MHz, $CDCl_3$): δ 37.24 (C-1), 31.64 (C-2), 71.80 (C-3), 42.28 (C-4), 140.74 (C-5), 121.71 (C-6), 31.88 (C-7), 31.90 (C-8), 50.14 (C-9), 36.49 (C-10), 21.07 (C-11), 39.75 (C-12), 42.20 (C-13), 56.75 (C-14), 24.35 (C-15), 28.24 (C-16), 56.03 (C-17), 11.97 (C-18), 19.38 (C-19), 36.13 (C-20), 18.76 (C-21), 33.93 (C-22), 26.04 (C-23), 45.81 (C-24), 29.13 (C-25), 19.02 (C-26), 19.81 (C-27), 23.05 (C-28), 11.85 (C-29).

***Stigmasterol* (5b)**

^{1}H NMR (600 MHz, $CDCl_3$): δ 3.50 (m, H-3), 5.33 (dd, *J* = 1.8, 4.8 Hz, H-6), 0.68 (s, CH_3-18), 0.99 (s, CH_3-19), 1.01 (d, *J* = 6.6 Hz, CH_3-21), 5.13 (dd, *J* = 8.4, 15.0 Hz, H-22), 5.00 (dd, *J* = 9.0, 15.0 Hz, H-23), 0.84 (d, *J* = 6.6 Hz, CH_3-26), 0.83 (d, *J* = 6.6 Hz, CH_3-27), 0.80 (t, *J* = 6.6 Hz, CH_3-29).^{13}C NMR (150 MHz, $CDCl_3$): δ 37.24 (C-1), 31.64 (C-2), 71.80 (C-3), 42.28 (C-4), 140.74 (C-5), 121.71 (C-6), 31.88 (C-7), 31.90 (C-8), 50.14 (C-9), 36.49 (C-10), 21.07 (C-11), 39.66 (C-12),42.20 (C-13), 56.75 (C-14), 24.35 (C-15), 28.91 (C-16), 55.93 (C-17), 12.03 (C-18), 19.38 (C-19), 40.49 (C-20),21.07 (C-21), 138.31 (C-22), 129.25 (C-23), 51.22 (C-24), 31.90 (C-25), 21.20 (C-26), 18.97 (C-27), 25.40 (C-28),12.24 (C-29).

Lupeol (6)

^{1}H NMR (600 MHz, $CDCl_3$): δ 4.65 (d, *J* = 2.4 Hz, H-29b), 4.54 (d, *J* = 2.4 Hz, H-29a), 3.18 (H-3), 0.95 (s, H_3-23), 0.74 (s, H_3-24), 0.77 (s, H_3-25), 0.92 (s, H_3-26), 1.01 (s, H_3-27), 0.81 (s, H_3-28), 1.66 (s, H_3-30). ^{13}C NMR (150 MHz, $CDCl_3$): δ 38.85 (C-1), 27.40 (C-2), 79.01 (C-3), 38.69 (C-4), 55.28 (C-5), 17.99 (C-6), 34.26 (C-7), 40.82 (C-8), 50.42 (C-9), 37.16 (C-10), 20.92 (C-11), 25.12 (C-12), 38.04 (C-13), 42.82 (C-14), 27.40 (C-15), 35.57 (C-16), 47.98 (C-17), 48.29 (C-18), 47.98 (C-19), 150.99 (C-20), 29.83 (C-21), 39.99 (C-22), 27.98 (C-23), 15.36 (C-24), 16.11 (C-25), 15.96 (C-26), 14.54 (C-27), 18.31 (C-28), 109.31 (C-29), 19.29 (C-30).

Lutein (7)

^{1}H NMR (600 MHz, $CDCl_3$): δ 1.05 (s, 2 ring A CH_3), 0.83 (s, ring B CH_3), 0.98 (s, ring B CH_3), 1.60 (allylic CH_3), 1.71 (allylic CH_3), 1.89 (allylic CH_3), 1.91 (allylic CH_3), 1.94 (2 allylic CH_3), 1.45, 1.75 (CH_2), 1.35, 1.85 (CH_2), 2.35, 2.00 (allylic CH_2), 2.38 (allylic CH), 4.23 (br s, CHOH), 3.98 (m, CHOH), 5.52 (br s, = CH), 5.41 (dd, *J* = 9.6, 15.0 Hz, = CH), 6.56-6.65, 6.33 (dd, *J* = 15.0, 3.0 Hz), 6.23 (br d, *J* = 9.6 Hz), 6.09-6.14 (= CH). ^{13}C NMR (150 MHz, $CDCl_3$): δ 37.12 (C-1), 48.41 (C-2), 65.11 (C-3), 42.53 (C-4), 126.15 (C-5), 138.02 (C-6), 125.57 (C-7), 138.71 (C-8), 135.69 (C-9), 131.29 (C-10), 124.92 (C-11), 137.56 (C-12), 136.41 (C-13), 132.57 (C-14), 130.08 (C-15), 28.72 (C-16), 30.25 (C-17), 21.61 (C-18), 12.75 (C-19, C-20), 34.02 (C-1′), 44.62 (C-2′), 65.94 (C-3′), 124.44 (C-4′), 137.72 (C-5′), 55.0 (C-6′), 128.71 (C-7′), 130.80 (C-8′), 135.06 (C-9′), 137.56 (C-10′), 124.80 (C-11′), 137.75 (C-12′), 136.48 (C-13′), 132.57 (C-14′), 130.08 (C-

15′), 24.27 (C-16′), 29.49 (C-17′), 22.89 (C-18′), 13.19 (C-19′), 12.81 (C-20′).

RESULTS AND DISCUSSION

Silica gel chromatography of the dichloromethane extract of the leaves of *I. philippinensis* yielded **1-7**. The structures of **1** and **3** were elucidated by extensive 1D and 2D NMR spectroscopy and confirmed by comparison of their NMR data with those reported in the literature for syringaresinol (**1**) (Monthong *et al.*, 2011) and isoscopoletin (**3**) (Ragasa *et al.*, 2014a).

The structures of **2** and **4-7** were identified by comparison of their NMR data with those reported in the literature for pinoresinol (**2**) (Ragasa *et al*., 2000), squalene (**4**) (Ragasa *et al*., 2015; Ragasa *et al.*, 2014b), β-sitosterol (**5a**) (Ragasa *et al.*, 2014c; Ebajo *et al*., 2015), stigmasterol (**5b**) (Ragasa *et al.*, 2014c; Ebajo *et al.*, 2015), lupeol (**6**) (Tsai *et al*., 2012; Ebajo *et al.*, 2015), and lutein (**7**) (Ragasa *et al*., 2015; Ebajo *et al.*, 2015).

These results indicate that *Ixora philippinensis* share similar chemical characteristics with other members of the genus *Ixora* which contained similar classes of compounds: *I. coccinea* – sterols, triterpenes, and aromatic compounds; *I. parviflora* – sterols and aromatic compounds; *I. undulata, I. javanica, I. arborea* – aromatic compounds; *I. amplexicaulis* – aromatic compounds and triterpene; and *I. finlaysoniana* – triterpenes. The differences may be due to the different polarities of the solvents used for extraction and the different parts of the plants studied: *I. philippinensis* - stems and leaves; *I. parviflora* – aerial parts; *I. undulate* - stems; *I. amplexicaulis* - stems and flowers; *I. javanica* – flowers; *I. finlaysoniana* – leaves; and *I. arborea* – stems.

CONCLUSION

Ixora philippinensis is an ornamental plant endemic to the Philippines with no reported chemical and biological activity studies. The dichloromethane extracts of this plant afforded **1-5b** from the stems, while the leaves yielded **4-7**. *I. philippinensis* contained sterols, triterpene, and aromatic compounds which belong to the same classes of compounds found in other *Ixora* species.

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