Dolabranes from the Chinese Mangrove, *Ceriops tagal*

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Six new dolabranes, named tagalsins P−U (**1**−**6**), were isolated from stems and twigs of a Chinese mangrove, *Ceriops tagal*, along with seven known dolabranes, an abietane, and a pimarane. The structures of these compounds were established on the basis of spectroscopic data or comparison with data in the literature. The relative configurations of tagalsins P and Q (**1**, **2**), two new 15,16-dinor-dolabranes, were confirmed by means of single-crystal X-ray diffraction analysis. This is the first report of 16-nordolabranes and 15,16-dinordolabranes from plants of the *Ceriops* genus. Tagalsins Q (**2**), R (**3**), and U (**6**) showed moderate antifeedant activity against the third-instar larvae of *Brontispa longissima* at a concentration of 1 mg/mL. However, none of the new dolabranes exhibited significant activity against human cancer cell lines.

The genus *Ceriops* (Rhizophoraceae) consists of two species and two varieties, namely, *C. tagal* (Perr.) C. B. Robinson, *C. decandra* (Griff.) Ding Hou, *C. tagal* var. *australasica*, and *C. tagal* var. *typical*. They are mangrove plants widely distributed along the sea coasts of Africa, Madagascar, South Asia, and South Pacific islands.[1] *C. tagal* is the only species of this genus distributed in southern China, mainly on Hainan Island.[2] The decoction of its leaves has been used for the treatment of malaria in China,[2] whereas that of its bark has been utilized for the treatment of hemorrhage and malignant ulcers in India.[3] Diterpenoids and triterpenoids are the main secondary metabolites of *C. tagal*.[1] Previous chemical investigation of this plant yielded 18 dolabranes [tagalsins A−O,[4−8] (5*S**,8*S**,9*S**,10*R**,13*S**)-3,16-dihydroxydolabr-3-ene-2,15-dione,[9,10] (5*S**,8*S**,9*S**,10*R**,13*S**)-dolabr-4(18)-ene-15,16-diol,[11] and erythroxyl-4(18),15-dien-3-one[12]], along with four pimaranes [isopimar-8(14)-ene-15,16-diol, 16-hydroxyisopimar-8(14)-en-15-one,[12] *ent*-16-hydroxy-8(14)-pimaren-15-one, and *ent*-8(14)-pimarene-15*R*,16-diol[13]]. Tagalsin C was found to exhibit moderate cytotoxicity against the HeLa human cervical carcinoma cell line.[8] Dolabranes are the main diterpenoids in this plant. In this paper, we present the isolation and characterization of six new dolabranes, named tagalsins P−U (**1**−**6**), from stems and twigs of *C. tagal*, collected in the mangrove wetlands of Hainan Island, China, along with seven known dolabranes, an abietane, and a pimarane. The structures of these compounds were established on the basis of spectroscopic data (new compounds) or comparison with data in the literature (known compounds). The stereostructures of tagalsins P (**1**) and Q (**2**) were confirmed by means of single-crystal X-ray diffraction analysis.

Results and Discussion

The EtOH extract of the stems and twigs of *C. tagal* was partitioned between H_2O and petroleum ether. The resulting nonpolar extract was subjected to column chromatography using silica gel, octadecylsilyl silica gel, and preparative HPLC to afford six new dolabranes, named tagalsins P−U (**1**−**6**), along with nine known compounds, including seven dolabranes, an abietane, and a pimarane. The structures of known compounds were identified by comparison of their spectroscopic data with those in the literature. The known compounds were assigned as (5*S**,8*S**,9*S**,10*R**,13*S**)-3-hydroxy-16-nor-2-oxodolabr-3-en-15-oic acid (**7**),[9] (5*S**,8*S**,9*S**,10*R**,13*S**)-3,16-dihydroxydolabr-3-ene-2,15-dione (**8**),[9] (5*S**,8*S**,9*S**,10*R**,13*S**)-2-hydroxy-16-nor-3-oxodolabr-1,4(18)-dien-15-oic acid (**9**),[14,15] (5*S**,8*S**,9*S**,10*R**,13*S**)-dolabr-3-ene-15,16-diol (**10**),[16] (5*S**,8*S**,9*S**,10*R**,13*S**)-dolabr-4(18)-ene-15,16-diol (**11**),[11,17] tagalsin H (**12**),[4] erythroxydiol Y (**13**),[17] abieta-8,11,13-trien-18-oic acid,[18] and *ent*-8(14)-pimarene-15*R*,16-diol.[19]

Tagalsin P (**1**), which formed colorless crystals, had the molecular formula $C_{18}H_{28}O_3$ as established by HR-TOFMS, indicating that **1** had five degrees of unsaturation. Its ^{1}H and ^{13}C NMR data (Tables 1 and 2) indicated that two of the five elements of unsaturation came from a carbonyl group and a carbon−carbon double bond. Therefore the molecule was tricyclic. The ^{13}C NMR data and DEPT experiments revealed that **1** had four tertiary methyls, six methylenes, two methines, and six quaternary carbons. The NMR data of **1** and its 2D NMR studies (HSQC and HMBC) (Figure 1) indicated the presence of a conjugated ketone (δ_C 194.9, C), a tetrasubstituted double bond (δ_C 146.5, qC; 137.7, C), and an oxygenated quaternary carbon (δ_C 71.7, C). Compound **1** was suggested to be a dolabrane containing a 3-hydroxy-4-methyl-2-enone cyclohexane moiety as its ring A. The NMR data (Tables 1 and 2) of **1** were similar to those for tagalsin G,[4] isolated from the same plant, except for the absence of resonances for a terminal vinylic group at C-13 and the presence of an oxygenated quaternary carbon (δ_C 71.7, C), which was assigned to C-13 by strong HMBC correlations from protons of H_3-17 (δ_H 1.25 s) to this quaternary carbon (Figure 1). The location of a hydroxy group at C-13 was suggested by the molecular formula of **1** and the chemical shift of this carbon.

The relative configuration of **1** was proposed on the basis of NOE interactions (Figure 2). The presence of NOE interactions between H-10/H_3-19, H-10/H-8, H-10/H-6β, H-8/H-6β, and H-8/H_3-17 and the absence of NOE interaction between H_3-20/H-8 allowed the assignment of the ring junctions as *cis* for A/B and *trans* for B/C, and a β-orientation for H_3-17, the same as those reported for tagalsin G.

In order to confirm the relative configuration of **1**, single-crystal X-ray analysis was carried out. A computer-generated perspective drawing of the X-ray model of **1** is shown in Figure 3. Its asymmetric unit contains two crystallographically independent molecules with similar chiralities, bond lengths, and angles (Figure

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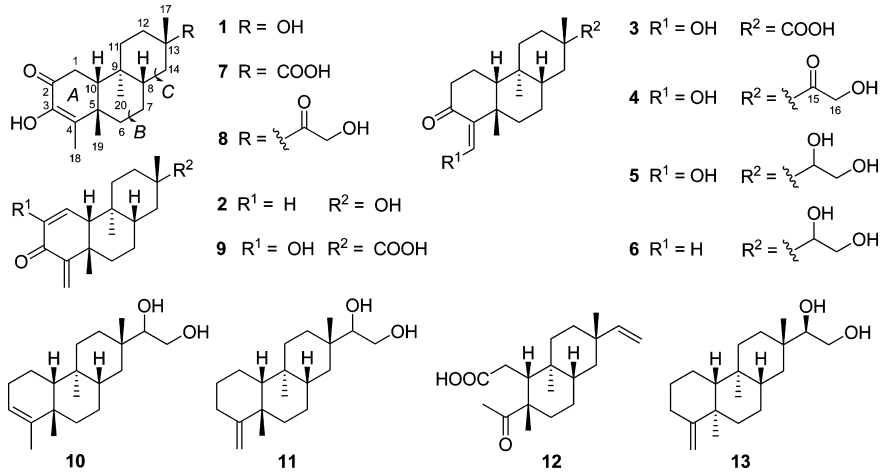

S19a). Compound **1** is a 15,16-dinor-dolabrane with a 3-hydroxy-4-methyl-2-enone cyclohexane moiety and a 13α-hydroxy group. The orientation of H-8, H-10, H_3-17, and H_3-19 is β and that of H_3-20 is α. Compound **1** consists of three rings, designated as A, B, and C, among which the ring A adopts a half-chair conformation, whereas rings B and C are in chair conformations. Molecular structures of **1** are stabilized by O−H···O intermolecular hydrogen bonds between O2/O6, O1′/O3, O1/O3″, and O6/O3″ (Figure

Table 1. ^{1}H NMR (500 MHz for **1**−**5** and 400 MHz for **6**) Data (δ) for Compounds **1**−**6** in Methanol-d_4 (J in Hz)

position	1	2	3	4	5	6
1α	2.67, d (18.5)	7.15, dd (10.5, 6.0)	2.06, m	2.05, m	2.05, m	2.15, m[a]
1β	2.92, dd (18.5, 6.5)		2.16, m	2.17, m	2.16, m	
2		6.26, d (10.5)	2.51, br s	2.50, m	2.50, m	2.55, m
6α	2.22, dt (14.0, 3.0)	2.27, d (14.0)	2.25, m	2.25, br d (14.5)	2.23, br d (14.5)	2.17, m[a]
6β	1.33, m[a]	1.54, m[a]	1.49, m[a]	1.50, m[a]	1.45, m[a]	1.48, m[a]
7α	1.22, m[a]	1.43, m[a]	1.30, m[a]	1.31, m[a]	1.27, m[a]	1.16, m[a]
7β		1.28, m[a]	1.18, m[a]	1.18, m[a]	1.13, br d (13.5)	
8	1.31, m[a]	1.42, m[a]	1.49, m[a]	1.53, m[a]	1.45, m[a]	1.44, m[a]
10	1.69, d (6.5)	2.15, d (6.0)	1.31, m[a]	1.32, m[a]	1.28, m[a]	1.37, m[a]
11α	1.76, ddd (13.5, 4.5, 3.0)	1.63, m[a]	1.78, m[a]	1.78, dt (13.5, 3.5)	1.71, dt (13.0, 3.5)	1.73, br d (13.0)
11β	1.05, dt (13.5, 4.0)	1.39, m[a]	1.18, m[a]	1.20, m[a]	1.08, m[a]	1.12, m[a]
12α	1.67, m[a]	1.66, m[a]	1.97, dt (14.0, 3.5)	1.88, dt (14.0, 4.5)	1.58, dt (14.0, 4.5)	1.52, m[a]
12β	1.51, m[a]	1.52, m[a]	1.47, m[a]	1.42, m	1.32, m[a]	1.32, m[a]
14α	1.52, m[a]	1.51, m[a]	1.72, m[a]	1.62, t (13.5)	1.45, m[a]	1.44, m[a]
14β	1.31, m[a]	1.43, m[a]	1.27, m[a]	1.21, m[a]	0.91, br d (12.0)	0.92, m[a]
15					3.21, dd (9.0, 2.5)	3.19, br d (8.8)
16a				4.44, s	3.71, dd (11.5, 2.5)	3.70, br d (11.2)
16b					3.43, dd (11.0, 9.0)	3.41, br t (10.0)
17	1.25, s	1.29, s	1.26, s	1.24, s	0.94, s	0.93, s
18a	1.88, s	6.11, br s	7.94, s	7.94, s	7.92, s	5.90, br s
18b		5.44, br s				5.33, br s
19	1.26, s	1.11, s	1.20, s	1.20, s	1.19, s	1.11, s
20	0.70, s	0.72, s	0.77, s	0.75, s	0.73, s	0.80, s

[a] Overlapped signals assigned by HSQC and HMBC spectra without designating multiplicity.

Table 2. ^{13}C NMR (100 MHz) Data (δ) for Compounds **1**−**6** in Methanol-d_4

position	1	2	3	4	5	6
1	35.1, CH_2	153.0, CH	17.2, CH_2	17.1, CH_2	17.2, CH_2	18.6, CH_2
2	194.9, C	131.0, CH	32.8, CH_2	32.8, CH_2	32.8, CH_2	37.4, CH_2
3	146.5, C	190.8, C	201.9, C	201.8, C	201.9, C	205.8, C
4	137.7, C	152.0, C	118.2, C	118.1, C	118.3, C	154.2, C
5	40.2, C	41.8, C	37.6, C	37.5, C	37.6, C	42.2, C
6	39.1, CH_2	37.2, CH_2	37.8, CH_2	37.7, CH_2	37.9, CH_2	38.6, CH_2
7	28.1, CH_2	26.6, CH_2	26.7, CH_2	26.7, CH_2	27.0, CH_2	27.1, CH_2
8	45.4, CH	44.9, CH	43.5, CH	43.2, CH	43.7, CH	43.5, CH
9	39.2, C	41.1, C	38.9, C	38.9, C	39.1, C	39.5, C
10	55.7, CH	58.5, CH	53.2, CH	53.1, CH	53.4, CH	53.7, CH
11	37.5, CH_2	38.3, CH_2	35.9, CH_2	35.6, CH_2	36.3, CH_2	36.5, CH_2
12	36.3, CH_2	36.3, CH_2	30.2, CH_2	29.0, CH_2	29.8, CH_2	29.9, CH_2
13	71.7, C	71.7, C	42.9, C	47.0, C	38.0, C	38.0, C
14	43.4, CH_2	43.9, CH_2	37.5, CH_2	36.3, CH_2	37.9, CH_2	37.9, CH_2
15			182.8, C	216.6, C	82.7, CH	82.7, CH
16				64.8, CH_2	63.7, CH_2	63.7, CH_2
17	26.9, CH_3	26.6, CH_3	22.0, CH_3	21.0, CH_3	19.8, CH_3	19.6, CH_3
18	11.9, CH_3	118.3, CH_2	171.7, CH	171.8, CH	171.9, CH	117.4, CH_2
19	32.2, CH_3	34.0, CH_3	36.1, CH_3	36.1, CH_3	36.1, CH_3	34.2, CH_3
20	14.5, CH_3	12.9, CH_3	13.1, CH_3	13.1, CH_3	13.2, CH_3	14.1, CH_3

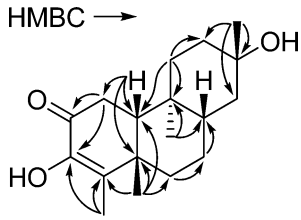

Figure 1. Selected HMBC correlations for tagalsin P (**1**).

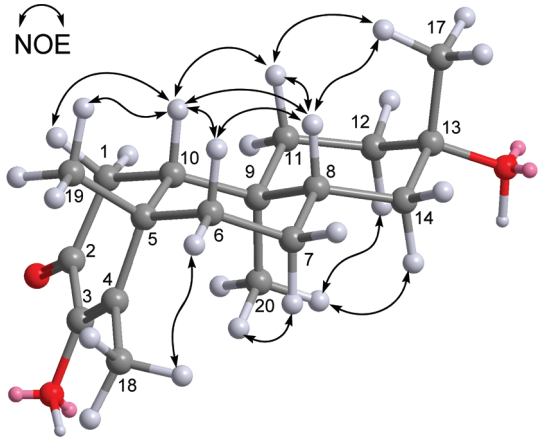

Figure 2. Diagnostic NOE interactions for tagalsin P (**1**).

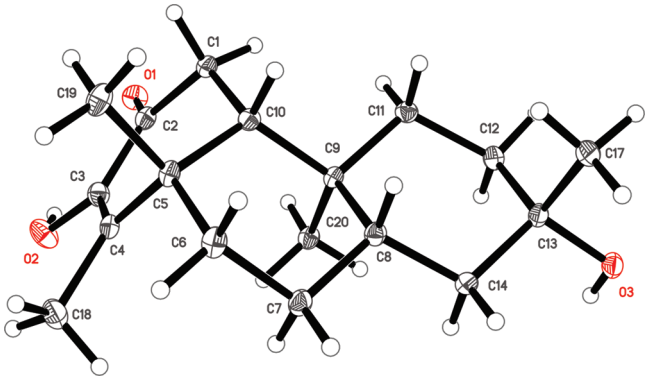

Figure 3. Perspective drawing of the X-ray structure of tagalsin P (**1**).

S19b). On the basis of the above results, the relative configuration of **1**, named tagalsin P, was identified as (5*S**,8*S**,9*S**,10*R**)-3,13*S**-dihydroxy-15,16-dinorlabr-3-en-2-one.

Tagalsin Q (**2**), appearing as colorless crystals, had the molecular formula $C_{18}H_{26}O_2$ as established by HR-TOFMS, indicating that **2** had six degrees of unsaturation. Three of the six elements of unsaturation came from a carbonyl group and two carbon−carbon double bonds. Therefore the molecule was tricyclic. The ^{13}C NMR data and DEPT experiments revealed that **2** had three tertiary methyls, six methylenes (one olefinic), four methines (two olefinic), and five quaternary carbons. The NMR data of **2** (Tables 1 and 2) indicated the presence of a conjugated ketone (δ_C 190.8, C), two double bonds (δ_C 153.0, CH; 131.0, CH; 152.0, C; 118.3, CH_2), and an oxygenated quaternary carbon (δ_C 71.7, C). Compound **2** was suggested to be a dolabrane containing a 4-methylene-3-enone cyclohexane moiety as its ring A. The NMR data (Tables 1 and 2) of **2** were similar to those of tagalsin O[8] isolated from the same plant, except for the absence of a terminal vinylic group at C-13 and the presence of an oxygenated quaternary carbon (δ_C 71.7, C), which was assigned to C-13 by strong HMBC correlations from protons of H_3-17 (δ_H 1.29, s) to this quaternary carbon (Figure 4).

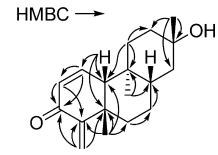

Figure 4. Selected HMBC correlations for tagalsin Q (**2**).

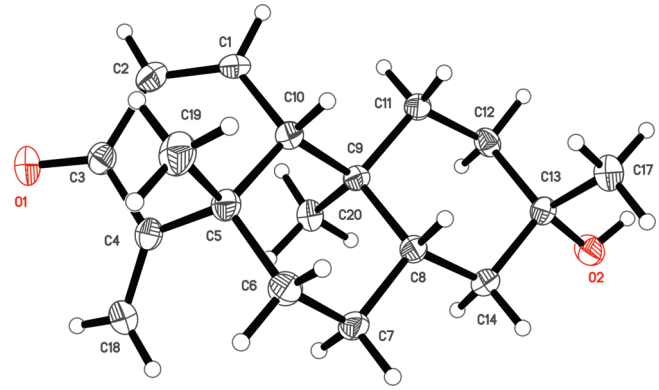

Figure 5. Perspective drawing of the X-ray structure of tagalsin Q (**2**).

The location of a hydroxy group at C-13 was suggested by the molecular formula of **2** and the chemical shift of this carbon.

The relative configuration of **2** was established by means of single-crystal X-ray analysis. A computer-generated perspective drawing of the X-ray model of **2** is shown in Figure 5. Compound **2** is a 15,16-dinor-dolabrane with a 4-methylene-3-enone cyclohexane moiety and a 13α-hydroxy group. The orientation of H-8, H-10, H_3-17, and H_3-19 is β and that of H_3-20 is α. Compound **2** consists of three rings, designated as A, B, and C, among which the ring A adopts a half-chair conformation, whereas rings B and C are in chair conformations. Molecular structures of **2** are stabilized by O−H···O intermolecular hydrogen bonds between O1′/O2 (Figure S20). The presence of NOE interactions between H-10/H_3-19, H-10/H-8, H-10/H-6β, H-8/H-6β, and H-8/H_3-17 and the absence of NOE interaction between H_3-20/H-8 were consistent with the X-ray structure. On the basis of the above results, the relative configuration of **2**, named tagalsin Q, was identified as (5*S**,8*S**,9*S**,10*R**)-13*S**-hydroxy-15,16-dinorlabr-1,4(18)-dien-3-one.

Tagalsin R (**3**) was a white, amorphous powder. Its molecular formula of $C_{19}H_{28}O_4$ was established by HR-TOFMS. The ^1H NMR data of **3** were similar to those of tagalsin F,[4] except for the presence of a carboxy group (δ_C 182.8, C) and the absence of a terminal vinylic group at C-13. Strong HMBC correlations from protons of H_3-17 (δ_H 1.26, s) to the carbonyl carbon (δ_C 182.8, C) revealed the carboxy group at C-13. Therefore, the relative configuration of **3**, named tagalsin R, was identified as (5*S**,8*S**,9*S**,10*R**,13*S**)-18-hydroxy-16-nor-3-oxodolabr-4(18)-en-15-oic acid.

Tagalsin S (**4**), a white, amorphous powder, had the molecular formula $C_{20}H_{30}O_4$, as established by HR-TOFMS, indicating an extra CH_2 compared to **3**. The ^1H NMR data of **4** were similar to those of **3**, except for the presence of a hydroxyacetyl group (δ_H 4.44, s; δ_C 216.6, C; 64.8, CH_2) and the absence of a carboxy group at C-13. Strong HMBC correlations from protons of H_3-17 (δ_H 1.24, s) to the ketone carbon (δ_C 216.6, C) of the hydroxyacetyl group assigned its location at C-13. Therefore, the relative configuration of **4**, named tagalsin S, was identified as (5*S**,8*S**,9*S**,10*R**,13*S**)-16,18-dihydroxydolabr-4(18)-ene-3,15-dione.

Tagalsin T (**5**), a white, amorphous powder, had the molecular formula $C_{20}H_{32}O_4$ as established by HR-TOFMS, which is two hydrogens more than in **4**. The ^1H NMR data of **5** were similar to those of **4**, except for the presence of a dihydroxyethyl group [δ_H

Table 3. Results of Antifeedant Bioassays for Compounds **1**−**6** against the Third-Instar Larvae of *Brontispa longissima*

compound	concentration (mg mL^{-1})	antifeedant rates at different exposure time	
		24 h (%)	48 h (%)
1	1	48	22
	0.5	18	6
	0.1	14	2
2	1	53	43
	0.5	50	36
	0.1	23	30
3	1	40	28
	0.5	37	30
	0.1	18	7
4	1	51	47
	0.5	45	37
	0.1	25	36
5	1	−5	−20
	0.5	−11	−31
	0.1	−32	−48
6	1	52	41
	0.5	41	31
	0.1	14	10

3.21 (dd, J = 9.0, 2.5 Hz), 3.43 (dd, J = 11.0, 9.0 Hz), 3.71 (dd, J = 11.5, 2.5 Hz); δ_C 82.7, CH; 63.7, CH_2] and the absence of the hydroxyacetyl group at C-13. The strong HMBC correlation from H_3-17 (δ_H 0.94 s) to the methine carbon (δ_C 82.7, CH) of the dihydroxyethyl group assigned its location at C-13. However, the relative configuration at C-15 was not established. Thus, the relative configuration of **5**, named tagalsin T, was identified as (5*S**,8*S**,9*S**,10*R**,13*S**)-15ξ,16,18-trihydroxydolabr-4(18)-en-3-one.

Tagalsin U (**6**) was obtained as a colorless oil. Its molecular formula of $C_{20}H_{32}O_3$ was established by HR-TOFMS. The ^{1}H NMR data of **6** were similar to those of **5**, except for the absence of a hydroxy group at C-18. The existence of an exomethylene (δ_H 5.90, br s; 5.33, br s; δ_C 117.4, CH_2) and strong HMBC correlations from its protons to C-4 (δ_C 154.2, C) of ring A assigned the location of the olefinic methene group at C-4. Therefore, the relative configuration of **6**, named tagalsin U, was elucidated as (5*S**,8*S**,9*S**,10*R**,13*S**)-15ξ,16-dihydroxydolabr-4(18)-en-3-one.

The new dolabranes, tagalsins P−U (**1**−**6**), were tested for their antifeedant activities by using a conventional leaf disk method against the third-instar larvae of *Brontispa longissima* (Gestro). Compounds **2**, **4**, and **6** exhibited moderate antifeedant activity at a concentration of 1 mg/mL (Table 3). The antifeedant rates of these compounds at the exposure time of 24 h were over 50%, and those at 48 h were over 40%. However, compounds **1** and **3** exhibited weak antifeedant activity at the same concentration, and compound **5** showed no activity.

All of the new dolabranes were tested for their cytotoxicity against human melanoma (A2058, G361), prostate (DU145), and breast (MDA-MB-468, MDA-MB-435) cancer cell lines by the MTT method.[20,21] However, none of them were active.

Dolabrane diterpenoids are a small group of natural products reported mainly from plants. To date, only 37 dolabranes have been characterized from the plant genera *Araucaria*, *Croton*, *Dichapetalum*, *Endospermum*, *Erythroxylum*, *Fagonia*, *Givotia*, *Helichrysum*, *Mallotus*, *Petalostigma*, *Rondeletia, Trigonia*, and *Thujopsis*[9,14−17,22−38] and from the liverwort *Schistochila aligera*,[39] whereas 18 dolabranes have been identified from the mangrove, *Ceriops tagal*. Obviously, *C. tagal* is a valuable source for the production of dolabranes.

Experimental Section

General Experimental Procedures. Melting points were measured on an X_4 micromelting point detector (Beijing Tech. Instrument Co. Ltd., China). Optical rotations were recorded on a Polartronic HNQW5 automatic high-resolution polarimeter (Schmidt & Haensch Co. Ltd.). UV spectra were obtained on a Beckman DU-640 UV spectrophotometer, and MALDI-TOFMS analysis were measured on a Bruker APEX II spectrometer in positive ion mode. NMR spectra were recorded in MeOH using a Bruker AV-400 or AV-500 spectrometer with TMS as the internal standard. Single-crystal X-ray diffraction analysis was measured on a Bruker Smart 1000 CCD system diffractometer with graphite-monochromated Mo Kα radiation (λ = 0.71073 Å at 110 K). Preparative HPLC was carried out on ODS columns (250 × 10 mm i.d., YMC) with a Waters 2998 photodiode array detector. For CC, silica gel (200−300 mesh) (Qingdao Mar. Chem. Ind. Co. Ltd.) and RP C_{18} gel (Cosmosil C18-PREP 140 μm, Nacalai Tesque, Kyoto, Japan) were used.

Plant Material. Stems and twigs of *Ceriops tagal* were collected in July 2002 in the mangrove wetlands of Hainan Island, China. The identification of the plant was performed by one of the authors (J.W.). A voucher sample (No. CT-01) is maintained in the Herbarium of the South China Sea Institute of Oceanology.

Extraction and Isolation. Dried stems and twigs (14.2 kg) of *C. tagal* were extracted five times with 95% EtOH at room temperature. The EtOH extract was concentrated under reduced pressure, followed by suspension in H_2O and extraction with petroleum ether. The resulting extract (87.5 g) was chromatographed on silica gel eluted using a petroleum ether−acetone system (100:0−2:1) to yield 101 fractions. Fractions 71−89 were combined and further separated using RP C_{18} CC (MeCN−H_2O, 50:50−100:0) to afford 26 subfractions. Then subfractions 6−12 were combined and subjected to preparative HPLC (YMC-Pack 250 × 10 mm i.d., MeCN−H_2O, 42:58, or MeCN−H_2O, 50:50, or MeOH−H_2O, 80:20) to afford **1** (48.1 mg), **2** (30.3 mg), **7** (208.2 mg), **8** (299.9 mg), **9** (22.2 mg), **10** (8.4 mg), **11** (44.1 mg), **12** (63.8 mg), **13** (12.1 mg), abieta-8,11,13-trien-18-oic acid (73.5 mg), and *ent*-8(14)-pimarene-15*R*,16-diol (101.7 mg). Fractions 90−96 were combined and further separated using RP C_{18} CC (MeCN−H_2O, 50:50−100:0) to afford 22 subfractions. Then subfractions 6−12 were combined and subjected to preparative HPLC (YMC-Pack 250 × 10 mm i.d., MeCN−H_2O, 35:75, or MeOH−H_2O, 66:34) to yield **3** (98.6 mg), **4** (77.6 mg), **5** (58.3 mg), and **6** (18.3 mg).

Tagalsin P (1): colorless crystals; mp 175−177 °C; $[\alpha]^{25}_D$ +68 (*c* 0.5, MeOH); UV (MeCN) λ_{max} (log ε) 288 (4.06) nm; ^{1}H and ^{13}C NMR data (see Tables 1 and 2); HR-TOFMS *m*/*z* 315.1949 [M + Na]$^+$ (calcd for $C_{18}H_{28}O_3Na$, 315.1936).

Tagalsin Q (2): colorless crystals; mp 155−157 °C; $[\alpha]^{25}_D$ +245 (*c* 0.5, MeOH); UV (MeCN) λ_{max} (log ε) 256 (4.03) nm; ^{1}H and ^{13}C NMR data (see Tables 1 and 2); HR-TOFMS *m*/*z* 297.1823 [M + Na]$^+$ (calcd for $C_{18}H_{26}O_2Na$, 297.1831).

Tagalsin R (3): white, amorphous powder; $[\alpha]^{25}_D$ −20 (*c* 0.4, MeOH); UV (MeCN) λ_{max} (log ε) 297 (3.94) nm; ^{1}H and ^{13}C NMR data (see Tables 1 and 2); HR-TOFMS *m*/*z* 343.1905 [M + Na]$^+$ (calcd for $C_{19}H_{28}O_4Na$, 343.1885).

Tagalsin S (4): white, amorphous powder; $[\alpha]^{25}_D$ −17 (*c* 0.1, MeOH); UV (MeCN) λ_{max} (log ε) 297 (3.72) nm; ^{1}H and ^{13}C NMR data (see Tables 1 and 2); HR-TOFMS *m*/*z* 357.2053 [M + Na]$^+$ (calcd for $C_{20}H_{30}O_4Na$, 357.2042).

Tagalsin T (5): white, amorphous powder; $[\alpha]^{25}_D$ −18 (*c* 0.3, MeOH); UV (MeCN) λ_{max} (log ε) 297 (3.82) nm; ^{1}H and ^{13}C NMR data (see Tables 1 and 2); HR-TOFMS *m*/*z* 359.2181 [M + Na]$^+$ (calcd for $C_{20}H_{32}O_4Na$ 359.2198).

Tagalsin U (6): colorless oil; $[\alpha]^{25}_D$ +5 (*c* 0.2, MeOH); UV (MeCN) λ_{max} (log ε) 241 (3.75) nm; ^{1}H and ^{13}C NMR data (see Tables 1 and 2); HR-TOFMS *m*/*z* 343.2258 [M + Na]$^+$ (calcd for $C_{20}H_{32}O_3Na$, 343.2249).

X-ray Crystal Data for Tagalsins P (1) and Q (2). Colorless crystals of **1** and **2** were obtained in the solvent mixture of acetone and methanol. Crystal data were obtained on a Bruker Smart 1000 CCD system diffractometer with graphite-monochromated Mo Kα radiation (λ = 0.71073 Å) and operating in the ω scan mode. The structure was solved by direct methods (SHELXS-97) and refined using full-matrix least-squares difference Fourier techniques. All non-hydrogen atoms were refined anisotropically, and all hydrogen atoms were placed in idealized positions and refined as riding atoms with the relative isotropic parameters. Crystallographic data (excluding structure factors) for **1** and **2** have been deposited with the Cambridge Crystallographic Data Center as supplementary publication numbers CCDC 779847 and 779848. Copies of the data can be obtained, free of charge, on application to CCDC, 12 Union Road, Cambridge CB2 1EZ, UK [fax: +44(0)-1233-336033 or e-mail: deposit@ccdc.cam.ac.uk].

Crystal Data for 1: orthorhombic, $C_{18}H_{28}O_3$, space group $P2(1)2(1)2(1)$ with $a = 7.6054(3)$ Å, $b = 10.8888(4)$ Å, $c = 38.7397(15)$ Å, $V = 3208.2(2)$ Å^3, $Z = 8$, $D_{calcd} = 1.211$ Mg/m^3, $m = 0.080$ mm^{-1}, and $F(000) = 1280$. Crystal size: $0.46 \times 0.42 \times 0.29$ mm^3. Independent reflections: 3984 with $R_{int} = 0.0267$. The structure was solved by direct methods (SHELXS-97) and refined using full-matrix least-squares difference Fourier techniques. All non-hydrogen atoms were refined anisotropically, and all hydrogen atoms were placed in idealized positions and refined as riding atoms with relative isotropic parameters. The final agreement factors are R1 = 0.0385 and wR2 = 0.0953 [$I > 2\sigma(I)$].

Crystal Data for 2: monoclinic, $C_{18}H_{26}O_2$, space group $P2(1)$ with $a = 10.9891(7)$ Å, $b = 21.7404(13)$ Å, $c = 12.9098(8)$ Å, $V = 3044.9(3)$ Å^3, $Z = 8$, $D_{calcd} = 1.197$ Mg/m^3, $m = 0.076$ mm^{-1}, and $F(000) = 1200$. Crystal size: $0.45 \times 0.42 \times 0.37$ mm^3. Independent reflections: 6740 with $R_{int} = 0.0276$. The structure was solved by direct methods (SHELXS-97) and refined using full-matrix least-squares difference Fourier techniques. All non-hydrogen atoms were refined anisotropically, and all hydrogen atoms were placed in idealized positions and refined as riding atoms with relative isotropic parameters. The final agreement factors are R1 = 0.0406 and wR2 = 0.0951 [$I > 2\sigma(I)$].

Antifeedant Bioassays. *Brontispa longissima* (Gestro), popularly named the coconut leaf beetle, is an insect pest of coconut palms in tropical areas. It has become an increasingly serious pest of coconuts throughout various growing regions in the Pacific, especially over the last three decades. Recently, it has become an insect pest on Hainan Island, China. The aim of our bioassay is to find natural products as biopesticidal leads for the control of this pest.

The adult insects of *B. longissima* were collected from leaves of coconut trees in a coconut field in Danzhou, Hainan Island, China, where pesticides had not been applied. These adult insects were reared and propagated in the laboratory under a controlled photoperiod (12: 12 h light:dark), temperature ($T = 25 \pm 1$ °C), relative humidity (RH = 70−80%), and fed daily with coconut leaves until they reached the early stage of the third-instar larvae, when they were used for antifeedant tests. Three groups, each containing 10 larvae, were used for the antifeedant testing of each compound. Compounds were dissolved in acetone at 1, 0.5, and 0.1 mg mL^{-1}. Wafer discs (1 cm diameter, 1 mm thick), made from coconut leaves, were dipped in acetone solutions of each compound for three seconds and then air-dried for five minutes. After drying, discs were placed in a Petri dish with the third-instar larvae of *B. longissima*. Acetone was chosen as the blank control. After 24 and 48 h, the antifeedant rates of the tested compounds were calculated.

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Supporting Information Available: HR-TOFMS and ^{1}H and ^{13}C NMR spectra of compounds **1**−**6**, HSQC and HMBC spectra of compounds **1** and **2**, and single-crystal X-ray diffraction data for **1** and **2**. This material is available free of charge via the Internet at http://pubs.acs.org.

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