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A LIGNAN FROM *LINDERA PRAECOX*

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Key Word Index—*Lindera praecox*; Lauraceae; lignan; praderin; isomagnolin; phylligenin.

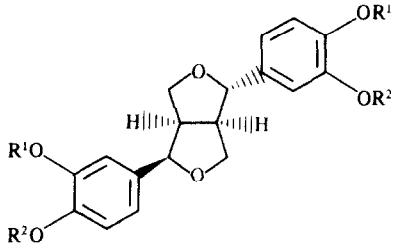
Abstract—A new 2,6-diaryl-3,7-dioxabicyclo[3.3.0]octane lignan, praderin, was isolated from the leaves of *Lindera praecox*.

INTRODUCTION

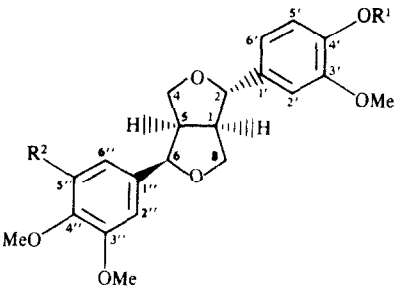
In the previous paper [1], we reported the isolation and the structural determination of a series of novel flavonoids having a *p*-menthene substituent from *Lindera umbellata* Thunb. var. *lancea* Momiyama, *L. umbellata* Thunb., and *L. umbellata* Thunb. var. *membranacea* (Maxim.) Momiyama. In the course of our further investigation of the genus *Lindera*, we isolated a new lignan praderin (**5**) from the leaves of *L. praecox* (Sieb. et Zucc) Blume. Here we report the isolation and characterization of this compound.

RESULTS AND DISCUSSION

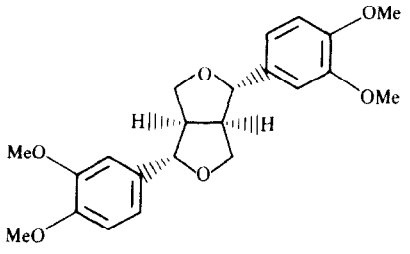
The new compound praderin (**5**) gave a bluish colour with ferric chloride–ethanol and was negative to the Gibbs reaction. In the ^{1}H NMR spectrum, characteristic signals for the epi-series of 2,6-diaryl-3,7-dioxabicyclo[3.3.0]octane lignan were found along with the signals of four methoxy groups, a hydroxy group and five aromatic protons. In the ^{13}C NMR spectrum, signals of four methoxy carbons were found and three (δ 56.3 × 2, 61.0) were present in a 3,4,5-trimethoxyphenyl group. With close similarity of all carbon signals between pra-



1 $R^1 + R^2 =$ —CH_2—
3 $R^1 = R^2 =$ Me



4 $R^1 = R^2 =$ H
5 $R^1 =$ H, $R^2 =$ OMe
6 $R^1 =$ Me, $R^2 =$ OMe
7 $R^1 =$ Ac, $R^2 =$ OMe



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derin and philligenin (**4**), except for the trimethoxyphenyl moiety (C-1″ ~ C-6″), the residual methoxy signal (δ 56.1) in praderin may be assigned to a methoxy function of a guaiacyl group. On acetylation of praderin, the signal of the C_5'-H is characteristically shifted downfield by 0.12 ppm. This fact suggest that the substituent on C-2 position of praderin is not 3-hydroxy-4-methoxyphenyl but 4-hydroxy-3-methoxyphenyl group. These results suggest that praderin is **5**. Methylation of praderin afforded epimagnolin (**6**) [2] which was isolated from the leaves of *Hernandia ovigera L.* [3]. Thus praderin is *rel*-(2*S*, 6*R*)-2-(4-hydroxy-3-methoxyphenyl)-6-(3,4,5-trimethoxyphenyl)-3,7-dioxabicyclo[3.3.0]octane.

In addition to the new compound praderin (**5**), four known lignans asarinin (**1**), eudesmin (**2**), epieudesmin (**3**), and philligenin (**4**) were isolated and identified from this plant.

EXPERIMENTAL

M P: uncorr. CC was run on Merck silica gel 60 (70–230 mesh). TLC was performed on glass plates precoated with Kieselgel 60 F_{254} (Merck). ^{13}C NMR spectra were determined at 25.00 MHz, with tetramethylsilane as an int. standard. Chemical shifts are in ppm.

Extraction and separation of compounds. The MeOH extract of dried leaves (8.7 kg) of *L. praecox* collected in May 1986 at Asuke-cho, Aichi prefecture was divided into *n*-hexane (116 g) and $CHCl_3$ soluble fractions (24 g). The former fraction gave asarinin (**1**, 535 mg), eudesmin (**2**, 62 mg) and epieudesmin (**3**, 54 mg). The latter fraction was chromatographed on a column of florisil (454 g) using $CHCl_3$ with gradually increasing proportions of Me_2CO as eluent and further purified by prep. TLC. The first fraction ($CHCl_3$) gave asarinin (**1**, 36 mg), eudesmin (**2**, 91 mg) and epieudesmin (**3**, 1790 mg). The second fraction ($CHCl_3$–Me_2CO, 10:1) gave philligenin (**4**, 8 mg) and praderin (**5**, 18 mg).

Praderin (**5**). Colourless prisms (MeOH), mp 155 ~ 156°. $[\alpha]_D$ + 113.8° ($CHCl_3$, *c* 0.05). IR $\nu_{max}^{CHCl_3}$ cm^{-1}: 3550, 1590, 1510. UV λ_{max}^{MeOH} nm: 228, 279. MS *m/z*: 402 (M^+, $C_{22}H_{26}O_7$). HRMS *m/z*: 402.1639 (M^+, calc. for $C_{22}H_{26}O_7$: 402.1676). ^{1}H NMR($CDCl_3$): δ 2.89 ~ 2.96 (1H, *m*, 1-H), 3.32 ~ 3.39 (2H, *m*, 4_β-H, 5-H), 3.83 ~ 3.90 (2H, *m*, 4_α-H, 8_β-H), 3.85, 3.88, 3.91 (12H, *s* × 3, 4 × OMe), 4.12 ~ 4.16 (1H, *m*, 8_α-H), 4.44 (1H, *d*, *J* = 7.0 Hz, 6-H), 4.86 (1H, *d*, *J* = 5.4 Hz, 2-H), 5.61 (1H, *s*, OH), 6.58 (2H, *s*, Ar-H), 6.84 (1H, *dd*, *J* = 8.1, 2.0 Hz, 6′-H), 6.89 (1H, *d*, *J* = 8.1 Hz, 5′-H), 6.91 (1H, *d*, *J* = 2.0 Hz, 2′-H). ^{13}C NMR ($CDCl_3$): δ 153.4 (C-3″, C-5″), 146.8 (C-3′), 145.5 (C-4′), 137.2 (C-4″), 134.2 (C-1″), 133.1 (C-1′), 119.3 (C-6′), 114.4 (C-5′), 108.7 (C-2′), 102.8 (C-2″, C-6″), 87.8 (C-2), 82.4 (C-6), 71.2 (C-8), 69.8 (C-4), 61.0 (OMe), 56.3 (OMe × 2), 56.1 (OMe), 54.5 (C-1) and 50.2 (C-5).

Methylation of praderin (**6**). Solution of praderin (**5**) (7 mg) in CH_2N_2–Et_2O (2 ml) was stirred overnight at room temp. The reaction mixture was evapd and the residue was purified by prep. TLC ($CHCl_3$–Me_2CO, 40:1) to afford a colourless oil (5 mg). The spectral data of this compound were superimposable on those of epimagnolin (**6**) [2].

Acetylation of praderin (**7**). A mixture of praderin (3 mg), Ac_2O (0.5 ml) and pyridine (0.5 ml) was allowed to stand overnight at room temp. The acetate was obtained as a colourless oil (3 mg). MS *m/z* : 444 (M^+, $C_{24}H_{28}O_8$), 402. ^{1}H NMR($CDCl_3$): δ 2.32 (3H, *s*, OAc), 2.91 ~ 2.95 (1H, *m*, 1-H), 3.34 ~ 3.37 (2H, *m*, 4_β-H, 5-H), 3.83 ~ 3.91 (1H, *m*), 3.85, 3.88 (12H, 2 × *s*, 4 × OMe), 4.11 ~ 4.20 (2H, *m*), 4.51 (1H, *d*, *J* = 7.1 Hz, 6-H), 4.85 (1H, *d*, *J* = 4.7 Hz, 2-H), 6.58 (2H, *s*, 2″-H, 6″-H), 6.91 (1H, *dd*, *J* = 8.1, 2.0 Hz, 6′-H), 7.01 (1H, *d*, *J* = 2.0 Hz, 2′-H), 7.01 (1H, *d*, *J* = 8.1 Hz, 5′-H).

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