Supporting Information
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A Concise Asymmetric Synthesis of (−)-Virolin, (−)-Surinamensin, (−)-Raphidecursinol B and (−)-Polysphorin

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Supporting Information

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General Information & Materials

Anhydrous solvents were dried and distilled by standard methods prior to use. Tetrahydrofuran (THF) and diethyl ether, when used as a solvent for reactions, were freshly distilled from sodium-benzophenone ketyl. Commercially available reagents were used without further purification unless otherwise specified. All the reactions were performed under an atmosphere of nitrogen in oven-dried glassware with magnetic stirring. Column chromatography was carried out using silica gel (60-120 mesh & 100-200 mesh) packed in glass columns. Analytical thin layer chromatography (TLC) was performed on precoated silica gel-60 F254 (0.5 mm) glass plates. Visualization of the spots on TLC plates was achieved by UV light. $^1$H-NMR (500 & 300 MHz) and $^{13}$C-NMR (75 MHz) were recorded in CDCl$_3$ solvent at ambient temperature. Chemical shifts are reported as $\delta$ values relative to internal TMS $\delta$ 0.0 for $^1$H-NMR and CHCl$_3$ $\delta$ 77.0 for $^{13}$C-NMR. $^1$H-NMR data is recorded as follows: chemical shift [multiplicity, coupling constant(s) $J$ (Hz), relative integral] where multiplicity is defined as: s = singlet; d = doublet; t = triplet; q = quartet; dd = double doublet; dt = double triplet; dq = double quartet; m = multiplet; bs = broad singlet. FTIR spectra were recorded on Bruker (Alpha) spectrometer. Optical rotation values were measured on Horiba high sensitive polarimeter using a 2 mL cell with a 10 mm path length. Mass spectra were recorded on Micro Mass VG-7070H mass spectrometer for ESI and are given in mass units (m/z). High resolution mass spectra (HRMS) [ESI+] were obtained using either a TOF or a double focusing spectrometer.
Experimental Procedures and Spectroscopic Data

**(E,Z)-Ethyl 2-(2-methoxy-4-(prop-1-enyl)phenoxy)acetate (2)**

To a mixture of vanillin 1 (2 g, 13.15 mmol, 1 eq) and anhydrous K₂CO₃ (3.63 g, 26.3 mmol, 2eq) in dry acetone (60 mL), ethyl bromoacetate (1.6 mL, 14.47 mmol, 1.1 eq) was added drop wise at rt and heated to reflux for 4h. The reaction mixture was cooled to rt and acetone was removed on a rotary evaporator. Water was added to the mixture and the residue was extracted with EtOAc (2 x 50 mL). The combined organic layer was washed with water and brine, dried over Na₂SO₄ and concentrated. The crude was purified by silica gel column chromatography (1:4 EtOAc/hexane). Yellow liquid, 3.06 g (98%); IR (film) νmax 3467, 2938, 1752, 1684, 1588, 1508, 1260, 1201, 1138, 1029, 775 cm⁻¹. ¹H-NMR (500 MHz, CDCl₃) δ 1.29 (t, J = 6.92 Hz, 3H), 3.94 (s, 3H), 4.25 (q, J = 14.83, 6.92 Hz, 2H), 4.72 (s, 2H), 6.85 (d, J = 7.91 Hz, 1H), 7.36 (dd, J = 7.91, 1.97 Hz, 1H), 7.39 (d, J = 1.97 Hz, 1H), 9.82 (s, 1H). ¹³C-NMR (75 MHz, CDCl₃): δ 13.90, 55.82, 61.37, 65.68, 109.71, 112.18, 125.87, 130.84, 149.70, 152.31, 167.83, 190.67. ESI MS: m/z 239 [M+H]+.

To the solution of above aldehyde (2 g, 8.4 mmol, 1 eq) in dry 1,4-dioxane (50 mL), Ph₃P=CHCH₃ (3.7 g, 10 mmol, 1.2 eq) and anhydrous K₂CO₃ (2.31 g, 16.8 mmol, 2 eq) were added and heated to reflux for 4h. After completion of the reaction, the reaction mixture was cooled to rt and the solvent was removed under vacuum. The residue was diluted with water and extracted twice with EtOAc (2 x 20 mL). The combined organic layer was washed with water, brine and dried over Na₂SO₄. The solvent was evaporated under vacuum and the crude product was obtained as inseparable **E, Z-ethyl-2-(2-methoxy-4-(prop-1-enyl)phenoxy)acetate mixture 2 (1:1, from crude ¹H-NMR)**.

**(E)-2-(2-Methoxy-4-(prop-1-enyl)phenoxy)acetic acid (3)**
The crude E, Z-mixture 2 was treated with bis(acetonitrile)palladium(II)chloride (236 mg, 10 mol %) in CH₂Cl₂ for 24 h at rt. The reaction mixture was diluted with diethyl ether and filtered through a short pad of celite. The solvent was removed under vacuum and the crude on purification by silica gel column chromatography (1:4 EtOAc/hexane) furnished E-2 as single product. Pale yellow liquid, 2.03 g (97%, E-isomer >99%); IR (film) νₘₐₓ 3504, 2939, 2848, 1759, 1590, 1464, 1387, 1330, 1201, 1142, 1064, 772 cm⁻¹. ¹H-NMR (500 MHz, CDCl₃): δ 1.24 (t, J = 7.72 Hz, 3H), 1.83 (d, J = 6.75 Hz, 3H), 3.82 (s, 3H), 4.18 (q, J = 14.48, 7.72 Hz, 2H), 4.56 (s, 2H), 6.00-6.07 (m, 1H), 6.26 (d, J = 16.41 Hz, 1H), 6.71-6.74 (m, 2H), 6.82 (s, 1H). ¹³C-NMR (75 MHz, CDCl₃): δ 14.00, 18.21, 55.63, 61.04, 66.45, 109.13, 114.24, 118.25, 124.20, 130.30, 132.56, 146.15, 149.41, 168.78. ESI MS: m/z 251 [M+H]⁺. HRMS (ESI): m/z [M+Na]⁺ calcd. for C₁₄H₁₈O₄Na 273 1102, found 273.1091.

To a solution of above ethyl ester (2 g, 8 mmol, 1 eq) in CH₂Cl₂/CH₃OH (9:1, v/v) mixture, methanolic solution of 2N NaOH (4 eq) was added and stirred at rt.³ After completion of the reaction, the solvent was removed under vacuum, the residue was diluted with water and extracted with diethyl ether to remove any unreacted ester. The aqueous layer was cooled to 0 ºC, acidified to pH 2-3 with 2N HCl, the white solid obtained was filtered and dried. The crude was purified by silica gel column chromatography (3:7 EtOAc/hexane) to afford the carboxylic acid 3 as a white solid, 1.44 g (97%); m. p. 90-92 ºC; IR (KBr) νₘₐₓ 3482, 3017, 2564, 1928, 1734, 1705, 1656, 1514, 1260, 1227, 1139, 1024, 968, 815 cm⁻¹. ¹H-NMR (300 MHz, CDCl₃): δ 1.88 (d, J = 6.04, 3H), 3.90 (s, 3H), 4.60 (s, 2H), 6.02-6.14 (m, 1H), 6.29 (d, J = 15.86 Hz, 1H), 6.81-6.85 (m, 3H) ¹³C-NMR (75 MHz, CDCl₃): δ 18.31, 55.79, 67.13, 109.30, 115.57, 118.67, 125.03, 130.23, 133.59, 145.94, 149.52, 172.89; ESI MS: m/z 223 [M+H]⁺. HRMS (ESI): m/z [M+Na]⁺ calcd. for C₁₂H₁₄O₄Na 245.0789, found 245.0789.

4-Allyl-2,6-dimethoxyphenol (5)

To a mixture of 2,6-dimethoxyphenol 4 (5g, 32.46 mmol, 1 eq) and anhydrous K₂CO₃ (8.57g, 64.93 mmol, 2eq) in dry acetone (80 mL) was added ally bromide (4.71g, 38.96 mmol, 1.2 eq) at rt and stirred under reflux for 6 h. After completion of the reaction, the
mixture was cooled to rt and solvent was removed in vacuo. The residue was diluted with water and extracted with EtOAc (2 x 50 mL). The organic layer was washed with water and brine, dried over Na₂SO₄ and concentrated. The crude was purified by silica gel column chromatography (1:4 EtOAc/hexane). Colourless oil, 6.23g (99%); **IR** (film) ν\textsubscript{max} 3436, 2925, 1596, 1477, 1384, 1252, 1111, 774, 729 cm\textsuperscript{-1}. **\textsuperscript{1}H-NMR** (300 MHz, CDCl₃): δ 3.82 (s, 6H), 4.46 (dt, J = 6.04, 1.51 Hz, 2H), 5.14 (dq, J = 10.57, 1.51 Hz, 1H), 5.28 (dq, J = 15.10, 1.51 Hz, 1H), 6.00-6.13 (m, 1H), 6.50 (d, J = 8.30 Hz, 2H), 6.89 (t, J = 8.30 Hz, 1H). **\textsuperscript{13}C-NMR** (75 MHz, CDCl₃): δ 56.03, 74.06, 105.25, 117.53, 123.57, 134.53, 136.77, 153.68. **ESI MS**: m/z 217 [M+Na]+.

The allyl aryl ether (3g, 15.45 mmol) was heated to reflux in dry CH₃CN (50 mL) with bismuth triflate (1g, 10 mol%) for 4 h.\textsuperscript{4} The reaction mixture was cooled to rt and filtered through small pad of silica and washed with CH₂Cl₂. The filtrate was concentrated and purified by silica gel column chromatography (1:4 EtOAc/hexane). Pale yellow oil, 9g (97 %); **IR** (film) ν\textsubscript{max} 3458, 2938, 2840, 1614, 1514, 1462, 1428, 1242, 1217, 1115, 722 cm\textsuperscript{-1}. **\textsuperscript{1}H-NMR** (500 MHz, CDCl₃): δ 3.27 (d, J = 7.00 Hz, 2H), 3.84 (s, 6H), 5.02-5.06 (m, 2H), 5.30 (bs, 1H), 5.85-5.93 (m, 1H), 6.33 (s, 2H). **\textsuperscript{13}C-NMR** (75 MHz, CDCl₃): δ 40.22, 56.12, 104.98, 115.60, 130.95, 132.83, 137.49, 146.85. **ESI MS**: m/z 217 [M+Na]+. **HRMS** (ESI): m/z [M+Na]+ calcd. for C₁₁H₁₄O₃Na 217.0840, found 217.0831.

**2-(4-Allyl-2,6-dimethoxyphenoxy)acetic acid (6)**

To a mixture of phenol 5 (2.5g, 12.85 mmol, 1 eq) and anhydrous K₂CO₃ (3.4g, 25.75 mmol, 2eq) in dry acetone (50 mL), ethylbromoacetate (2.36g, 14.17 mmol, 1.1 eq) was added drop wise and heated to reflux for 5 h. The reaction mixture was cooled to rt and acetone was removed under vacuum. The residue was diluted with water and extracted with EtOAc (2 x 30 mL). The organic layer was washed with water and brine, dried over Na₂SO₄ and concentrated. The crude product obtained was purified by silica gel column chromatography (1:4 EtOAc/hexane). Pale yellow liquid, 3.57g (99%); **IR** (film) ν\textsubscript{max} 3497, 2978, 2938, 2840, 1762, 1734, 1592, 1504, 1459, 1422, 1241, 1199, 1129, 1073, 821 cm\textsuperscript{-1}. **\textsuperscript{1}H-NMR** (500 MHz, CDCl₃): δ 1.30 (t, J = 7.01 Hz, 3H), 3.28 (d, J = 6.23 Hz, 2H), 3.81 (s,
6H), 4.23 (q, J = 7.01, 14.81 Hz, 2H), 4.51 (s, 2H), 5.04-5.09 (m, 2H), 5.84-5.94 (m, 1H), 6.33 (s, 2H). \(^{13}\)C-NMR (75 MHz, CDCl\(_3\)): \(\delta\) 13.90, 40.14, 55.70, 60.50, 69.34, 105.10, 115.72, 134.17, 135.75, 136.78, 152.29, 169.15. ESI MS: \(m/z\) 281 [M+H]+. HRMS (ESI): \(m/z\) [M+H]+ calcd. for C\(_{15}\)H\(_{21}\)O\(_5\) 281.1388, found 281.1391.

To a solution of above ethyl ester (1.5g, 5.35 mmol, 1 eq) in CH\(_2\)Cl\(_2\)/CH\(_3\)OH (9:1, v/v) mixture, methanolic solution of 2N NaOH (4 eq) was added and stirred at rt.\(^3\) After completion of the reaction, the solvent was removed under vacuum, the residue was diluted with water and extracted with diethyl ether to remove any unreacted ester. The aqueous layer was then cooled to 0 ºC, acidified to pH 2-3 with 2N HCl and the white solid was filtered, washed with water and dried. The crude was purified by silica gel column chromatography (3:7 EtOAc/hexane) affording the carboxylic acid 6 as white solid, 1.32g (98%), m.p. 82-84 ºC; IR \(\nu_{\text{max}}/\text{cm}^{-1}\) (KBr) 3294, 3079, 3010, 2964, 2939, 2841, 1763, 1736, 1602, 1509, 1460, 1340, 1264, 1125, 1036, 908, 827, 707; \(^1\)H-NMR (300 MHz, CDCl\(_3\)): \(\delta\) 3.31 (d, \(J = 6.04\) Hz, 2H), 3.89 (s, 6H), 4.51 (s, 2H), 5.06-5.10 (m, 2H), 5.82-5.95 (m, 1H), 6.39 (s, 2H); \(^{13}\)C-NMR (75 MHz, CDCl\(_3\)): \(\delta\) 40.42, 56.08, 71.24, 105.31, 116.37, 134.51, 136.60, 137.38, 151.62, 170.81; ESI MS: \(m/z\) 275 [M+Na]+; HRMS (ESI): \(m/z\) 275.0886 [M+Na]+ for C\(_{13}\)H\(_{16}\)O\(_5\)Na, calcd: 275.0895.

**(S)-4-Isopropyl-5,5-diphenyloxazolidin-2-one (7)**

White solid, m.p. 252-254 ºC, [lit\(^5\) 250-252 ºC]; [\(\alpha\)]\(_D\)\(^{25}\) = –257 (c 0.32, CHCl\(_3\)), [lit\(^5\) [\(\alpha\)]\(_D\) = –259.4 (c 0.32, CHCl\(_3\))]. \(^1\)H-NMR (300 MHz, CDCl\(_3\)): \(\delta\) 0.69, (d, \(J = 6.98\) Hz, 3H), 0.90 (d, \(J = 6.31\) Hz, 3H), 1.80-1.95 (m, 1H), 4.31 (d, \(J = 3.02\) Hz, 1H), 6.25 (b, 1H), 7.22-7.38 (m, 8H), 7.50-7.52 (m, 2H). ESI MS: 282 [M+H]+.

**Procedure for the preparation of chiral precursor**

1. \(\text{MeO}\) \(\text{Cl} \) \(\text{THF, 0°C} \)
2. \(\text{R}^2\) \(\text{O} \) \(\text{C} \) \(\text{R}^1\) \(\text{THF, 0°C} \)

\( R^1 = H, R^2 = (E)\text{-propenyl} \)

\( R^1 = \text{OMe}, R^2 = \text{allyl} \)
\textit{n}-BuLi (4.95 mL of 1M solution in toluene, 1.1 eq) was added to a stirred solution of oxazolidin-2-one 7 (1 eq) in THF at 0 \textdegree C. After 20 min, the reaction mixture was cooled to –78 \textdegree C and acid chloride (8 or 9)[prepared from the corresponding acid (3 or 6) (1 eq) using oxalylchloride (1.2 eq) and DMF (cat) in CH\textsubscript{2}Cl\textsubscript{2}] was added drop wise as a solution in THF. After stirring for 20 min at –78 \textdegree C, the temperature was allowed to reach rt gradually and stirring was continued at rt for 3 h. The reaction mixture was cooled to 0 \textdegree C and quenched with saturated aqueous NH\textsubscript{4}Cl solution followed by acetic acid. The reaction mixture was extracted with EtOAc (2 x 20 mL) and the organic layer was washed with saturated NaHCO\textsubscript{3} solution then with brine, dried over Na\textsubscript{2}SO\textsubscript{4} and concentrated. The crude was purified by silica gel column chromatography (1:4 EtOAc/hexane).

\textit{(S, E)- 4-Isopropyl-3-(2-(2-methoxy-4-(prop-1-enyl)phenoxy)acetyl)-5, 5-diphenyloxazolidin-2-one (10)}}

\[
\begin{align*}
\text{O} & \quad \text{N} \\
\text{O} & \quad \text{Ph} \\
\text{O} & \quad \text{Ph} \\
\text{O} & \quad \text{OMe} \\
\end{align*}
\]

Thick liquid, 2 g (92%); \([\alpha]_{D}^{25} = -91.7 \text{ (c 2.645, CHCl}_3)\); \textbf{IR} (film) \textit{v}_{\text{max}} 3435, 2928, 1778, 1511, 1450, 1219, 1028, 772 cm\textsuperscript{-1}. \textbf{\textsuperscript{1}H-NMR} (300 MHz, CDCl\textsubscript{3}): \(\delta 0.79 \text{ (d, } J = 6.79 \text{ Hz, 3H)}, 0.89 \text{ (d, } J = 6.79 \text{ Hz, 3H)}, 1.85 \text{ (d, } J = 6.04 \text{ Hz, 3H)}, 1.93-2.00 \text{ (m, 1H)}, 3.82 \text{ (s, 3H)}, 4.97-5.27 \text{ (dd, } J = 18.12 \text{ z, 2H)}, 5.33 \text{ (d, } J = 3.02 \text{ Hz, 1H)}, 5.99-6.08 \text{ (m, 1H)}, 6.26 \text{ (d, } J = 15.86 \text{ Hz, 1H)}, 6.43 \text{ (d, } J = 8.30 \text{ Hz, 1H)}, 6.64 \text{ (d, } J = 8.30 \text{ Hz, 1H)}, 6.80 \text{ (s, 1H)}, 7.25-7.47 \text{ (m, 10H)}. \textbf{\textsuperscript{13}C-NMR} (75 MHz, CDCl\textsubscript{3}): \(\delta 16.40 18.41, 21.78, 29.81, 55.79, 64.72, 67.81, 109.12, 113.28, 118.37, 124.28, 125.62, 125.85, 128.15, 128.47, 128.81, 129.08, 130.53, 132.36, 137.77, 141.91, 146.12, 167.946. \textbf{ESI MS}: m/z 486 [M+H]\textsuperscript{+}. \textbf{HRMS} (ESI): \(m/z \text{ [M+Na]}\textsuperscript{+}\) calcd. for C\textsubscript{30}H\textsubscript{31}NO\textsubscript{5}Na 508.2099, found 508.2085.

\textit{(S)-3-(2-(4-Allyl-2,6-dimethoxyphenoxy)acetyl)-4-isopropyl-5,5-diphenyloxazolidin-2-one (11)}}

\[
\begin{align*}
\text{O} & \quad \text{N} \\
\text{O} & \quad \text{MeO} \\
\text{O} & \quad \text{Ph} \\
\text{O} & \quad \text{Ph} \\
\end{align*}
\]
Colour less oil, 1.88g (92%); [α]D^25 = -96.8 (c 1.645, CHCl₃); IR (film) νmax 3442, 2965, 2936, 1781, 1730, 1592, 1450, 1420, 1364, 1210, 1128, 992, 760, 705 cm⁻¹. H-NMR (300 MHz, CDCl₃): δ 0.78 (d, J = 6.04 Hz, 3H), 0.94 (d, J = 6.04 Hz, 3H), 1.93-2.03 (m, 1H), 3.26 (d, J = 6.79 Hz, 2H), 3.65 (s, 6H), 4.97-5.14 (m, 4H), 5.41 (d, J = 3.02 Hz, 1H), 5.80-5.95 (m, 1H), 6.29 (s, 2H), 7.23-7.38 (m, 8H), 7.47-7.49 (m, 2H). C-NMR (75 MHz, CDCl₃): δ 15.71, 21.13, 29.37, 39.81, 55.33, 63.80, 70.96, 89.80, 104.90, 115.35, 124.99, 125.20, 127.40, 127.79, 128.03, 128.33, 134.10, 135.13, 136.55, 137.40, 141.58, 151.76, 152.23, 168.03. ESI MS: m/z 538 [M+Na]^+. HRMS (ESI): m/z [M+Na]^+ calcd. for C₃₁H₃₃O₆Na 538.2205, found 538.2200.

Procedure for the Aldol reaction

To a solution of 10 or 11 (1.03 mmol, 1 eq) in CH₂Cl₂ at 0 °C, n-Bu₂BOTf (1.13 mL, 1 M solution in CH₂Cl₂, 1.1 eq) was added and stirred at rt. After 15 min i-Pr₂NEt (0.21 mL, 1.23 mmol, 1.2 eq) was added and stirred for a further 30 min. The reaction mixture was cooled to -78 °C and a solution of aldehyde (1.1eq) in CH₂Cl₂ was then added slowly over 45 min via syringe pump. After stirring for 1 h, the resultant mixture was warmed to 0 °C and stirred for 3 h. The reaction mixture was quenched with MeOH/H₂O₂ (1:1 v:v), extracted with CH₂Cl₂, washed with brine, dried over Na₂SO₄ and concentrated under vacuum. The crude product was purified by silica gel column chromatography (3:7 EtOAc/hexane).

(S)-3-((2S,3R)-3-(3,4-Dimethoxyphenyl)-3-hydroxy-2-(2-methoxy-4-((E)-prop-1-enyl)phenoxy)propanoyl)-4-isopropyl-5,5-diphenyloxazolidin-2-one (14)
Colourless gel, 577 mg, (86%); \([\alpha]_D^{25} = -96.3\) (c 0.855, CHCl₃); **IR** (film) \(v_{\text{max}}\) 3492, 2931, 1778, 1721, 1595, 1512, 1450, 1371, 1264, 1211, 1177, 1141, 1029, 858, 808, 761, 704 cm\(^{-1}\). **\(^1\text{H-NMR}\)** (300 MHz, CDCl₃): \(\delta\) 0.66 (d, \(J = 6.78\) Hz, 3H), 0.82 (d, \(J = 7.17\) Hz, 3H), 1.84 (d, \(J = 6.42\) Hz, 3H), 1.88-1.93 (m, 1H), 3.27 (b, 1H), 3.77 (s, 3H), 3.80 (s, 3H), 3.82 (s, 3H), 4.61 (d, \(J = 3.77\) Hz, 1H), 5.28 (d, \(J = 2.83\) Hz, 1H), 5.96-6.08 (m, 1H), 6.13 (d, \(J = 3.77\) Hz, 1H), 6.24 (d, \(J = 15.67\) Hz, 1H), 6.51 (d, \(J = 8.30\) Hz, 1H), 6.67-6.75 (m, 3H), 6.79 (d, \(J = 1.32\) Hz, 1H), 6.85 (d, \(J = 1.70\) Hz, 1H), 7.23-7.31 (m, 10H). **\(^{13}\text{C-NMR}\)** (75 MHz, CDCl₃): \(\delta\) 16.10, 18.31, 21.63, 29.88, 55.56, 55.75, 64.78, 73.78, 80.55, 89.89, 109.59, 109.84, 110.38, 117.69, 118.48, 119.07, 124.74, 125.29, 125.72, 127.96, 128.31, 128.63, 128.71, 130.33, 130.79, 133.60, 137.82, 141.45, 145.79, 148.41, 150.11, 152.77, 168.89. **ESI MS**: \(m/z\) 669 [M+NH₄\(^+\)]. **HRMS** (ESI): \(m/z\) [M+Na\(^+\)]\(^+\) calcld. for C\(_{39}\)H\(_{41}\)NO\(_8\)Na 674.2729, found 674.2730.

\((S)-3-((2S,3R)-3-Hydroxy-2-(2-methoxy-4-((E)-prop-1-enyl)phenoxy)-3-(3,4,5-trimethoxyphenyl)propanoyl)-4-isopropyl-5,5-diphenyloxazolidin-2-one\) (15)

Colourless gel, 610 mg, (87%); \([\alpha]_D^{25} = -45.6\) (c 0.765, CHCl₃); **IR** (film) \(v_{\text{max}}\) 3471, 2934, 1780, 1713, 1594, 1510, 1451, 1373, 1239, 1127, 1035, 761, 706 cm\(^{-1}\). **\(^1\text{H-NMR}\)** (300 MHz, CDCl₃): \(\delta\) 0.70 (d, \(J = 6.10\) Hz, 3H), 0.83 (d, \(J = 6.98\) Hz, 3H), 1.83 (d, \(J = 6.23\) Hz, 3H), 1.89-1.96 (m, 1H), 3.72 (s, 3H), 3.77 (s, 6H), 3.79 (s, 3H), 4.53 (d, \(J = 3.96\) Hz, 1H), 5.30 (d, \(J = 2.64\) Hz, 1H), 5.96-6.08 (m, 1H), 6.11 (d, \(J = 3.96\) Hz, 1H), 6.24 (d, \(J = 15.67\) Hz, 1H), 6.51 (s, 2H), 6.69 (s, 2H), 6.78 (s, 1H), 7.27-7.33 (m, 10H). **\(^{13}\text{C-NMR}\)** (75 MHz, CDCl₃): \(\delta\)
16.23, 18.32, 21.67, 29.81, 55.74, 55.85, 60.65, 65.04, 73.79, 80.55, 90.30, 103.59, 109.61, 117.67, 118.43, 124.83, 125.29, 125.79, 128.06, 128.38, 128.81, 128.95, 130.32, 134.37, 137.31, 137.66, 141.35, 145.77, 150.11, 152.76, 153.08, 168.67.  

ESI MS: 704 [M+Na]+.  

HRMS (ESI): m/z [M+Na]+ calcd. for C₄₀H₄₃NO₉Na 704.2835, found 704.2855.

(S)-3-((2S,3R)-2-(4-Allyl-2,6-dimethoxyphenoxy)-3-hydroxy-3-(3,4,5-trimethoxyphenyl)propanoyl)-4-isopropyl-5,5-diphenyloxazolidin-2-one (16)

Thick liquid, 629 mg (87%); [α]D²⁵ = −55.6 (c 0.815, CHCl₃); IR (film) νmax 3466, 2929, 2851, 1779, 1723, 1593, 1455, 1242, 1128, 760 cm⁻¹. ¹H-NMR (400 MHz, CDCl₃): δ 0.77 (d, J = 7.00 Hz, 3H), 0.88 (d, J = 7.00 Hz, 3H), 1.90-1.98 (m, 1H), 3.24 (d, J = 7.00 Hz, 2H), 3.67 (s, 3H), 3.71 (s, 6H), 3.78 (s, 6H), 4.52 (d, J = 6.00 Hz, 1H), 5.00-5.05 (m, 2H), 5.24 (d, J = 4.00 Hz, 1H), 5.81-5.91 (m, 1H), 6.25 (s, 2H), 6.33 (d, J = 6.00 Hz, 1H), 6.40 (s, 2H), 7.20-7.30 (m, 10H). ¹³C-NMR (75 MHz, CDCl₃): δ 16.34, 21.50, 29.65, 29.98, 40.35, 55.71, 55.90, 60.52, 65.05, 74.45, 81.20, 89.69, 103.56, 105.19, 116.04, 125.05, 125.93, 127.96, 128.27, 128.67, 128.85, 133.90, 134.19, 136.03, 136.95, 137.05, 138.02, 141.24, 151.72, 152.41, 152.63, 168.98. ESI MS: m/z 734 [M+Na]+. HRMS (ESI): m/z [M+Na]+ calcd. for C₄₁H₄₅NO₁₀Na 734.2941, found 734.2940.

Procedure for reductive removal of the auxiliary⁵
To a solution of the adduct (1 eq) in Et₂O (20 mL), LiAlH₄ (8 eq) was added and the mixture was stirred at rt for 2 h. The reaction mixture was cooled to 0 ºC and quenched with 1M NaOH solution and Et₂O was added. The organic layer was separated and washed with 1M HCl, brine and dried over Na₂SO₄. Solvent was evaporated under vacuum. The crude was purified by silica gel column chromatography (1:1 EtOAc/hexane).

(1R,2R)-1-(3,4-Dimethoxyphenyl)-2-(2-methoxy-4-((E)-prop-1-enyl)phenoxy)propane-1,3-diol (17)

Pale yellow oil, 167 mg (97%); [α]_D^{25} = −65.9 (c 0.68, CHCl₃); IR (film) ν_max 3436, 2925, 1549, 1510, 1446, 1419, 1263, 1219, 1138, 1027, 772 cm⁻¹. ^1H-NMR (300 MHz, CDCl₃): δ 1.88 (dd, J = 6.79, 1.51 Hz, 3H), 2.60 (b, 1H), 3.38 (dd, J = 12.08, 3.02 Hz, 1H), 3.57 (dd, J = 12.08, 3.02 Hz, 1H), 3.85 (s, 3H), 3.86 (s, 3H), 3.91 (s, 3H), 4.93 (d, J = 7.54 Hz, 1H), 6.13-6.15 (m, 1H), 6.30 (dd, J = 15.86, 1.51 Hz, 1H), 6.77-6.85 (m, 3H), 6.90-6.99 (m, 3H). ^13C-NMR (75 MHz, CDCl₃): δ 18.33, 55.82, 55.86, 60.98, 73.85, 89.46, 109.28, 109.90, 111.00, 119.23, 119.57, 120.87, 125.42, 130.27, 132.10, 134.44, 146.43, 148.86, 149.05, 151.15. ESI MS: m/z 397 [M+Na]^+. HRMS (ESI): m/z [M+Na]^+ calcd. for C₂₁H₂₆O₆Na 397.1627, found 397.1615.

(1R,2R)-2-(2-Methoxy-4-((E)-prop-1-enyl)phenoxy)-1-(3,4,5-trimethoxyphenyl)propane-1,3-diol (18)

Colourless oil, 174 mg (98%); [α]_D^{25} = −12 (c 0.205, CHCl₃); IR (film) ν_max 3435, 2917, 2851, 1687, 1384, 1256, 1196, 1021, 773 cm⁻¹. ^1H-NMR (500 MHz, CDCl₃): δ 1.87 (d, J = 6.04 Hz, 3H), 3.56-3.72 (m, 2H), 3.78 (s, 3H), 3.81 (s, 6H), 3.87 (s, 3H), 4.02-4.08 (m, 1H), 4.87 (d, J = 4.53 Hz, 1H), 6.04-6.14 (m, 1H), 6.29 (d, J = 15.86 Hz, 1H), 6.55 (s, 2H), 6.80-6.83 (m, 3H). ^13C-NMR (75 MHz, CDCl₃): δ 18.38, 55.81, 56.10, 60.83, 72.78, 87.37,

(1R,2R)-2-(4-Allyl-2,6-dimethoxyphenoxy)-1-(3,4,5-trimethoxyphenyl)propane-1,3-diol (19)

![Chemical structure](image)

Colourless oil, 292 mg (96 %); [α]D²₅ = –2.5 (c 1.08, CHCl₃); **IR** (film) νmax 3468, 2925, 2853, 1727, 1572, 1455, 1128, 772 cm⁻¹. **¹H-NMR** (500 MHz, CDCl₃): δ 3.27 (d, J = 12.01 Hz, 1H), 3.32 (d, J = 6.00 Hz, 3H), 3.55 (d, J = 12.01 Hz, 1H), 3.75 (d, J = 8.00 Hz, 1H), 3.78 (s, 3H), 3.85 (s, 6H), 3.88 (s, 6H), 4.97 (d, J = 8.00 Hz, 1H), 5.07-5.09 (m, 2H), 5.86-5.94 (m, 1H), 6.40 (s, 2H), 6.66 (s, 2H). **¹³C-NMR** (75 MHz, CDCl₃): δ 29.62, 40.47, 56.03, 60.44, 60.75, 74.31, 88.79, 104.11, 105.37, 116.33, 135.63, 136.74, 136.79, 152.75, 153.10. **ESI MS**: m/z 457 [M+Na]⁺. **HRMS (ESI)**: m/z [M+Na]⁺ calcd. for C₂₃H₃₀O₈Na: 457.1838, found 457.1845.

**Procedure for mono tosylation**

To a solution of diol (1 eq) in CH₂Cl₂ (20 mL), DMAP (cat) and Et₃N (1.5 eq) were added and cooled to 0 °C. To this mixture p-toluenesulfonylchloride (1.1 eq) in CH₂Cl₂ (10 mL) was added at 0 °C and stirred at rt for 3 h. The reaction mixture was washed with sat. aq NaHCO₃ and brine. The organic layer was dried over Na₂SO₄ and concentrated. The crude product was purified by flash chromatography (3:7 EtOAc/hexane) and used immediately for the next reaction.

(2R,3R)-3-(3,4-Dimethoxyphenyl)-3-hydroxy-2-(2-methoxy-4-((E)-prop-1-enyl)phenoxy)propyl-4-methylbenzenesulfonate
Yellow liquid, 135 mg, (96%); IR (film) $\nu_{max}$ 3447, 2925, 1509, 1264, 1176, 1027, 772 cm$^{-1}$.  
$^1$H-NMR (500 MHz, CDCl$_3$): $\delta$ 1.87 (d, $J = 5.95$, 3H), 2.42 (s, 2H), 3.82 (s, 3H), 3.84 (s, 3H), 3.86 (s, 3H), 4.00-4.03 (m, 1H), 4.07 (dd, $J = 11.06$, 3.40 Hz, 1H), 4.76 (d, $J = 7.66$ Hz, 1H), 6.06-6.11 (m, 1H), 6.28 (d, $J = 15.32$ Hz, 1H), 6.71-6.84 (m, 6H), 7.23 (d, $J = 8.51$ Hz, 2H), 7.65 (d, $J = 8.51$ Hz, 2H). **ESI MS**: $m/z$ 551 [M+Na]$^+$.  

(2R,3R)-3-Hydroxy-2-(2-methoxy-4-((E)-prop-1-enyl)phenoxy)-3-(3,4,5-trimethoxyphenyl)propyl 4-methylbenzenesulfonate

Yellow liquid, 132 mg, (96%); IR (film) $\nu_{max}$ 3435, 2924, 2853, 1597, 1384, 1126, 773 cm$^{-1}$.  
$^1$H-NMR (500 MHz, CDCl$_3$): $\delta$ 1.87 (d, $J = 6.92$ Hz, 3H), 2.42 (s, 3H), 3.78 (s, 3H), 3.81 (s, 3H), 3.85 (s, 6H), 3.93-3.96 (m, 1H), 4.03-4.09 (m, 2H), 4.77 (d, $J = 6.92$ Hz, 1H), 6.03-6.10 (m, 1H), 6.27 (d, $J = 15.82$ Hz, 1H), 6.55 (s, 2H), 6.71 (s, 2H), 6.80 (s, 1H), 7.24 (d, $J = 7.91$ Hz, 2H), 7.66 (d, $J = 7.91$ Hz, 2H). **ESI MS**: $m/z$ 581 [M+Na]$^+$.  

(2R,3R)-2-(4-Allyl-2,6-dimethoxyphenoxy)-3-hydroxy-3-(3,4,5-trimethoxyphenyl)propyl 4-methylbenzenesulfonate

Yellow liquid, 265 mg (98%). IR (film) $\nu_{max}$ 3467, 2926, 2853, 1727, 1592, 1455, 1384, 1128, 662 cm$^{-1}$. $^1$H-NMR (300 MHz, CDCl$_3$) $\delta$ 2.42 (s, 3H), 3.30 (d, $J = 6.61$ Hz, 2H), 3.77 (s, 6H), 3.78 (s, 3H), 3.81 (s, 6H), 4.02-4.06 (m, 2H), 4.43 (dd, $J = 10.19$, 3.21 Hz, 1H), 4.65
(b, 1H), 4.90 (d, $J = 8.03$ Hz, 1H), 5.05-5.10 (m, 2H), 5.82-5.96 (m, 1H), 6.34 (s, 2H), 6.54 (s, 2H), 7.26 (d, $J = 8.12$ Hz, 2H), 7.69 (d, $J = 8.12$ Hz, 2H). **ESI MS:** $m/z$ 611 [M+Na]$^+$. 

**Procedure for reduction of the tosylate**

To a solution of tosylate (1 eq) in Et$_2$O (20 mL), LiAlH$_4$ (2 eq) was added and stirred at rt for 2 h. The reaction mixture was cooled to 0 °C and quenched with 1M NaOH solution and Et$_2$O was added. The organic layer was washed with 1M HCl, brine and dried over Na$_2$SO$_4$. Solvent was evaporated under vacuum. The crude was purified by silica gel column chromatography (2:3 EtOAc/hexane).

(–)-Virolin (I)

White resin, 66 mg (98%); [$\alpha$]$_D^{25} = -82$ (c 0.26, CHCl$_3$); [lit$^7$] [$\alpha$]$_D^{25} = -99.6$ (c 1.0, CHCl$_3$)]. **IR** (film) $\nu_{max}$ 3435, 2922, 1600, 1384, 1263, 1140, 1030 cm$^{-1}$. **$^1$H-NMR** (300 MHz, CDCl$_3$): $\delta$ 1.14 (d, $J = 6.23$ Hz, 3H, 9$'$-$H$), 1.88 (d, $J = 6.42$ Hz, 3H, 9-$H$), 3.85 (s, 3H, OCH$_3$), 3.87 (s, 3H, OCH$_3$), 3.91 (s, 3H, OCH$_3$), 3.97-4.06 (m, 1H, 8-$H$), 4.57 (d, $J = 8.30$ Hz, 1H, 7-$H$), 6.02-6.13 (m, 1H, 8$'$-$H$), 6.30 (d, $J = 15.48$ Hz, 1H, 7$'$-$H$), 6.75-6.80 (m, 4H, Ar-$H$), 6.84-6.88 (m, 4H, Ar-$H$). **$^{13}$C-NMR** (75 MHz, CDCl$_3$): $\delta$ 17.05, 18.37, 55.74, 55.87, 78.40, 84.16, 109.20, 110.03, 110.86, 118.78, 119.04, 119.99, 124.89, 130.44, 147.06, 149.05, 149.21, 151.09. **ESI MS:** $m/z$ 381 [M+Na]$^+$. **HRMS** (ESI): $m/z$ [M+Na]$^+$ calcd. for C$_{21}$H$_{26}$O$_5$Na 381.1677, found 381.1670.

(–)-Surinamensin (II)
Colourless oil, 68 mg (98%). \([\alpha]_D^{30} = -3.8 (c 0.42, \text{CHCl}_3)\). [lit\(^8\) \([\alpha]_D^{25} = -3.9 (c 0.615, \text{CHCl}_3)\)].

**IR (film)** \(\nu_{\text{max}}\) 3436, 2923, 1593, 1384, 1126 cm\(^{-1}\). **\(^1H\)-NMR** (300 MHz, CDCl\(_3\)): \(\delta\) 1.20 (d, \(J = 6.0 \text{ Hz}, 3\text{H}, 9-H\)), 1.88 (dd, \(J = 6.7, 1.5 \text{ Hz}, 3\text{ H}, 9'-H\)), 3.83 (s, 3\text{H}, OCH\(_3\)), 3.86 (s, 6\text{H}, OCH\(_3\)), 3.92 (s, 3\text{H}, OCH\(_3\)), 4.10 (dd, \(J = 8.3,6.0 \text{ Hz}, 1\text{H}, 8-H\)), 4.17 (b, 1\text{H}, OH), 4.60 (d, \(J = 8.30 \text{ Hz}, 1\text{H}, 7-H\)), 6.15 (dq, \(J = 15.8, 6.0 \text{ Hz}, 1\text{H}, 8'-H\)), 6.36 (dd, \(J = 15.8, 1.5 \text{ Hz}, 1\text{H}, 7'-H\)), 6.60 (s, 2\text{H}, Ar-H), 6.86 (dd, \(J = 8.3, 1.5 \text{ Hz}, 1\text{H}, Ar-H\)), 6.94 (d, \(J = 8.3 \text{ Hz}, 1\text{H}, Ar-H\)).

**\(^{13}C\)-NMR** (75 MHz, CDCl\(_3\)): \(\delta\) 17.19, 18.40, 55.73, 56.10, 60.82, 78.75, 84.10, 104.23, 109.13, 118.78, 119.04, 124.98, 130.38, 133.54, 135.58, 146.65, 150.73, 153.18. **ESI MS**: \(m/z\) 411 [M+Na]\(^+\). **HRMS** (ESI): \(m/z\) \([\text{M+Na}]^+\) calcd. for C\(_{22}\)H\(_{28}\)O\(_6\)Na: 411.1783, found 411.1789.

**\((-\)**-Raphidecursinol B (III)**

Colourless oil, 69 mg (98%); \([\alpha]_D^{30} = -68 (c 0.62, \text{CHCl}_3)\); [lit\(^7\) \([\alpha]_D^{25} = -77 (c 1.0, \text{CHCl}_3)\), lit\(^8\) \([\alpha]_D^{25} = -52.2^\circ (c 5.26, \text{CHCl}_3)\)].

**IR (film)** \(\nu_{\text{max}}\) 3468, 2925, 2853, 1732, 1591, 1504, 1463, 1422, 1233, 1127, 1037 cm\(^{-1}\). **\(^1H\)-NMR** (300 MHz, CDCl\(_3\)): \(\delta\) 1.19 (d, \(J = 6.04 \text{ Hz}, 3\text{H}, H-9\)), 3.32 (d, \(J = 6.79 \text{ Hz}, 2\text{H}, H-7'\)), 3.78 (s, 3\text{H}, OCH\(_3\)), 3.84 (s, 6\text{H}, OCH\(_3\)), 3.86 (s, 6\text{H}, OCH\(_3\)), 3.97-4.10 (m, 1\text{H}, H-8), 4.51 (d, \(J = 8.30 \text{ Hz}, 1\text{H}, H-7\)), 4.78 (b, 1\text{H}, OH), 5.06-5.12 (m, 2\text{H}, H-9'), 5.85-5.99 (m, 1\text{H}, H-8'), 6.39 (s, 2\text{H}, Ar-H), 6.52 (s, 2\text{H}, Ar-H). **\(^{13}C\)-NMR** (75 MHz, CDCl\(_3\)): \(\delta\) 17.64, 40.45, 55.93, 56.07, 60.73, 79.32, 86.24, 104.32, 105.45, 116.12, 135.18, 135.87, 136.34, 136.97, 137.53, 152.62, 153.03. **ESI MS**: \(m/z\) 441 [M+Na]\(^+\). **HRMS** (ESI): \(m/z\) \([\text{M+Na}]^+\) calcd. for C\(_{23}\)H\(_{30}\)O\(_7\)Na: 441.1783, found 441.1789.

**\((-\)**-Polysphorin (IV)**

S15
To a solution of (−)-Raphidecursinol B (III) (25 mg, 0.06 mmol) in dry methanol (10 mL) was added catalytic amount of PdCl₂ (3.5 mg, 0.02 mmol) at room temperature and stirred for 24 h. The reaction mixture was filtered through a small pad of silica and concentrated under vacuum. The crude residue was purified by silica gel column chromatography (1:4 EtOAc/hexane).

Colourless oil, 24 mg (98%); [α]D30 = −90.7 (c 0.48, CHCl₃); [lit⁸ [α]D25 = −87 (c 0.34, CHCl₃)].

IR (film) νmax 3444, 2924, 2853, 1715, 1592, 1505, 1463, 1383, 1328, 1261, 1127, 769 cm⁻¹.

¹H NMR (300 MHz, CDCl₃): δ 1.20 (d, J = 6.0 Hz, 3H, 9-H), 1.88 (dd, J = 6.7, 1.5 Hz, 3H, 9'-H), 3.80 (s, 3H, OMe), 3.85 (s, 6H, OMe), 3.88 (s, 6H, OMe), 3.94-4.00 (m, 1H, 8-H), 4.56 (d, J = 8.3 Hz, 1H, 7-H), 6.05-6.16 (m, 1H, 8'-H), 6.31 (d, J = 15.8, 1H, 7'-H), 6.56 (s, 4H, Ar).

¹³C NMR (75 MHz, CDCl₃): δ 17.74, 18.31, 55.94, 56.10, 60.82, 79.45, 86.49, 103.03, 104.47, 125.68, 130.90, 134.00, 136.13, 136.41, 137.67, 152.94, 153.18. ESI MS: m/z 441 [M+Na]+. HRMS (ESI): m/z [M Na]+ calcd. for C₂₃H₃₀O₇Na 441.1889, found 441.1875.
Table 1. $^1$H-chemical shifts of $1'$-H and $2'$-H protons (ppm, CDCl$_3$, 300 MHz) and coupling constants $J_{(1'H-2'H)}$ & $J_{(2'H-1'H)}$ (Hz) of the adducts 14-16.

<table>
<thead>
<tr>
<th>Entry no</th>
<th>1'-H</th>
<th>2'-H</th>
<th>$J_{(1'H-2'H)}$ &amp; $J_{(2'H-1'H)}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>4.61 (d)</td>
<td>6.13 (d)</td>
<td>3.77</td>
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<td>15</td>
<td>4.53 (d)</td>
<td>6.11 (d)</td>
<td>3.96</td>
</tr>
<tr>
<td>16</td>
<td>4.52 (d)</td>
<td>6.33 (d)</td>
<td>6.00</td>
</tr>
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</table>

Table 2. Comparison of $^1$H-chemical shifts of H7, H8, H9, H7', H8' and H9' protons (ppm, CDCl$_3$) and coupling constants $^3J_{H7-H8}$ (Hz) of compounds I-IV

<table>
<thead>
<tr>
<th>Entry no</th>
<th>H7</th>
<th>H8</th>
<th>$^3J_{H7-H8}$</th>
<th>H9</th>
<th>H7'</th>
<th>H8'</th>
<th>H9'</th>
<th>Ref.No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(–)-I</td>
<td>4.57 (d)</td>
<td>3.97-4.06 (m)</td>
<td>8.30</td>
<td>1.14 (d)</td>
<td>6.30 (d)</td>
<td>6.02-6.13 (m)</td>
<td>1.88 (d)</td>
<td>present$^a$</td>
</tr>
<tr>
<td>(–)-I</td>
<td>4.60 (bd)</td>
<td>4.07 (dq)</td>
<td>8.4</td>
<td>1.13 (dd)</td>
<td>6.32 (dq)</td>
<td>6.12 (dq)</td>
<td>1.85 (dd)</td>
<td>7$^b$</td>
</tr>
<tr>
<td>(–)-II</td>
<td>4.60 (d)</td>
<td>4.10 (dd)</td>
<td>8.30</td>
<td>1.20 (d)</td>
<td>6.36 (dd)</td>
<td>6.15 (dq)</td>
<td>1.88 (dd)</td>
<td>present$^a$</td>
</tr>
<tr>
<td>(–)-II</td>
<td>4.60 (d)</td>
<td>4.10 (m)</td>
<td>8.2</td>
<td>1.20 (d)</td>
<td>6.36 (d)</td>
<td>6.15 (dq)</td>
<td>1.88 (d)</td>
<td>8$^c$</td>
</tr>
<tr>
<td>(–)-III</td>
<td>4.51 (d)</td>
<td>3.97-4.10 (m)</td>
<td>8.30</td>
<td>1.19 (d)</td>
<td>3.32 (d)</td>
<td>5.85-5.99 (m)</td>
<td>5.06-5.12 (m)</td>
<td>8$^c$</td>
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<tr>
<td>(–)-III</td>
<td>4.58 (d)</td>
<td>3.95 (dq)</td>
<td>8.1</td>
<td>1.20 (d)</td>
<td>3.33 (d)</td>
<td>5.95 (m)</td>
<td>5.11 (dd)</td>
<td>8$^c$</td>
</tr>
<tr>
<td>(–)-III</td>
<td>4.56 (bd)</td>
<td>3.91 (dq)</td>
<td>8.4</td>
<td>1.18 (d)</td>
<td>3.32 (bd)</td>
<td>5.93 (ddt)</td>
<td>5.10, 5.07 (dq)</td>
<td>7$^b$</td>
</tr>
<tr>
<td>(–)-IV</td>
<td>4.56 (d)</td>
<td>3.94-4.00 (m)</td>
<td>8.30</td>
<td>1.20 (d)</td>
<td>6.31 (d)</td>
<td>6.05-6.16 (m)</td>
<td>1.88 (dd)</td>
<td>present$^a$</td>
</tr>
<tr>
<td>(–)-IV</td>
<td>4.57 (d)</td>
<td>3.92 (dq)</td>
<td>8.4</td>
<td>1.19 (d)</td>
<td>6.31 (dq)</td>
<td>6.15 (dq)</td>
<td>1.85 (dd)</td>
<td>7$^b$</td>
</tr>
<tr>
<td>(+)-IV</td>
<td>4.58 (d)</td>
<td>3.96 (dq)</td>
<td>8.4</td>
<td>1.21 (d)</td>
<td>6.33 (d)</td>
<td>6.16 (dq)</td>
<td>1.88 (d)</td>
<td>8$^c$</td>
</tr>
</tbody>
</table>

$^a$ 300 MHz, $^b$ 600 MHz, $^c$ 400 MHz

Table 3. Comparison of $^{13}$C-chemical shifts of C7, C8, C9, C7', C8' and C9' carbons (ppm, CDCl$_3$) of compounds I-IV

<table>
<thead>
<tr>
<th>Entry no</th>
<th>C7</th>
<th>C8</th>
<th>C9</th>
<th>C7'</th>
<th>C8'</th>
<th>C9'</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(–)-I</td>
<td>78.40</td>
<td>84.16</td>
<td>17.05</td>
<td>130.44</td>
<td>124.89</td>
<td>18.37</td>
<td>present$^a$</td>
</tr>
<tr>
<td>(–)-I</td>
<td>78.6</td>
<td>84.4</td>
<td>17.3</td>
<td>130.6</td>
<td>125.1</td>
<td>18.6</td>
<td>7$^b$</td>
</tr>
<tr>
<td>(–)-II</td>
<td>78.75</td>
<td>84.10</td>
<td>17.19</td>
<td>130.38</td>
<td>124.98</td>
<td>18.40</td>
<td>present$^a$</td>
</tr>
<tr>
<td>(–)-II</td>
<td>78.7</td>
<td>84.1</td>
<td>17.2</td>
<td>130.4</td>
<td>125.0</td>
<td>18.3</td>
<td>8$^c$</td>
</tr>
<tr>
<td>(–)-III</td>
<td>79.32</td>
<td>86.24</td>
<td>17.64</td>
<td>40.45</td>
<td>136.97</td>
<td>116.12</td>
<td>present$^a$</td>
</tr>
<tr>
<td>(–)-III</td>
<td>79.3</td>
<td>86.2</td>
<td>17.6</td>
<td>40.4</td>
<td>137.0</td>
<td>116.1</td>
<td>8$^c$</td>
</tr>
<tr>
<td>(–)-IV</td>
<td>79.45</td>
<td>86.49</td>
<td>17.74</td>
<td>130.90</td>
<td>125.68</td>
<td>18.31</td>
<td>present$^a$</td>
</tr>
<tr>
<td>(–)-IV</td>
<td>79.6</td>
<td>86.7</td>
<td>17.9</td>
<td>130.9</td>
<td>125.9</td>
<td>18.6</td>
<td>7$^b$</td>
</tr>
<tr>
<td>(+)-IV</td>
<td>79.4</td>
<td>86.4</td>
<td>17.7</td>
<td>130.8</td>
<td>125.6</td>
<td>18.3</td>
<td>8$^c$</td>
</tr>
</tbody>
</table>

$^a$ 75 MHz, $^b$ 150 MHz, $^c$ 100 MHz
References:
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