Constituents from the Stems of *Hibiscus taiwanensis*

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Five new compounds, hibicuslide A (1), hibicuslide B (2), hibicuslide C (3), hibicutaiwanin (4), hibicusin (5), and fifty-one known compounds have been isolated from the stems of *Hibiscus taiwanensis*. The structures of these compounds were determined by spectroscopic and chemical transformation methods. Among them, mansonone H (19) and uncarinic acid A (30) inhibited HIV replication in H9 lymphocyte cells. The 9,9′-*O*-feruloyl-(−)-secoisolaricinresinol (12), myriceric acid C (29), and uncarinic acid A (30) showed cytotoxic activity against human lung carcinoma and breast carcinoma.

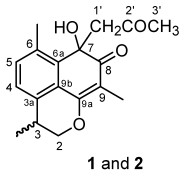
Key words Malvaceae; *Hibiscus taiwanensis*; lignan; triterpenoid; cytotoxicity; anti-HIV

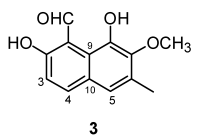
Hibiscus taiwanensis Hu (Malvaceae) is native to Taiwan. It is a moderately tall shrub and widely distributed throughout Taiwan.[1)] The stem and root of *H. taiwanensis* have been used as anti-inflammatory, antifungal, antipyretic, and anthelmintic agents in traditional Chinese medicine.[2)] The crude methanol extract of the stems of *H. taiwanensis* showed cytotoxic activity against gastric and nasopharyngeal carcinoma cell lines in our preliminary screening. Therefore, an investigation of its chemical constituents and their pharmacological evaluation was undertaken.

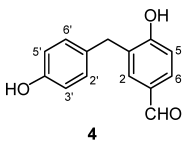
The methanolic extract of *H. taiwanensis* was suspended in H_2O and defatted with hexane. The aqueous solution was partitioned with $CHCl_3$ and EtOAc, successively. The obtained $CHCl_3$ and EtOAc soluble fractions were individually separated by silica gel column chromatography to afford fifty-six compounds, including five new compounds: hibicuslide A (**1**), hibicuslide B (**2**), hibicuslide C (**3**), hibicutaiwanin (**4**), hibicusin (**5**), and fifty-one known compounds: hibicuwanin A (**6**),[3)] hibicuwanin B (**7**),[3)] (7*S*,8*S*)-demethylcarolignan E (**8**),[3)] *threo*-carolignan E (**9**),[4)] *erythro*-carolignan E (**10**),[4)] *threo*-1-C-syringylglycerol (**11**),[5)] 9,9′-*O*-feruloyl-(−)-secoisolaricinresinol (**12**),[6)] dihydrodehydrodiconiferyl alcohol (**13**),[7)] boehmenan (**14**),[4)] (−)-syringaresinol (**15**),[8)] cleomiscosin A (**16**),[9)] cleomiscosin C (**17**),[9)] mansonone E (**18**),[10)] mansonone H (**19**),[11)] hibiscone C (**20**),[12)] isohemigossypol-1-methyl ether (**21**),[13)] gossyvertin (**22**),[14)] *N*-*trans*-feruloyltyramine (**23**),[15)] *N*-*cis*-feruloyltyramine (**24**),[16)] 2-(2-hydroxytricosanoylamino)-1,3,4-hexadecanetriol (**25**),[17)] myricerol (**26**),[18)] myriceric acid A (**27**),[18)] myriceric acid B (**28**),[18)] myriceric acid C (**29**),[18)] uncarinic acid A (**30**),[19)] uncarinic acid B (**31**),[19)] 3-oxo-olean-12-en-28-oic acid (**32**),[20)] scopoletin (**33**),[21)] scoparone (**34**),[22)] 4-hydroxybenzoic acid (**35**),[15)] ferulic acid (**36**),[15)] methyl *trans*-ferulate (**37**),[23)] methyl *cis*-ferulate (**38**),[24)] lignocerylferulate (**39**),[25)] caffeic acid (**40**),[17)] methyl caffeate (**41**),[26)] hexacosanyl caffeate (**42**),[27)] vanillin (**43**),[17)] vanillic acid (**44**),[15)] methyl vanillate (**45**),[15)] benzoic acid (**46**),[17)] *p*-coumaric acid (**47**),[15)] methyl *p*-coumarate (**48**),[28)] *p*-formylbenzoic acid (**49**),[29)] methyl *p*-formylbenzoate (**50**),[30)] syringic acid (**51**),[31)] syringaldehyde (**52**),[15)] sinapinaldehyde (**53**),[32)] ficusol (**54**),[33)] a mixture of β-sitosterol and stigmasterol (**55**), and β-sitosteryl-β-D-glucoside (**56**). The isolation, structural elucidation and biological activity evaluation of these compounds are presented herein.

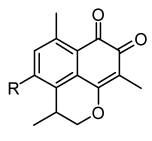
Isomeric hibiscuslide A (**1**) and hibiscuslide B (**2**) were obtained as orange syrup and had the same molecular formula $C_{18}H_{20}O_4$ by high resolution EI-MS. They had similar spectral property and resembled those of mansonone E (**18**), a tricyclic diketone. The full assignment of ^{1}H- and ^{13}C-NMR signals was confirmed by COSY, NOESY, HMQC, and HMBC spectra.

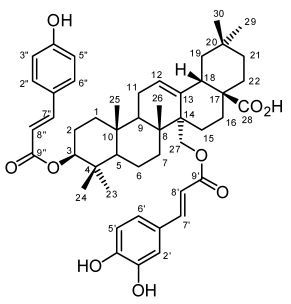
In the ^{1}H-NMR spectrum of **1**, a –CH(CH_3)CH_2O– unit presented at δ 1.32 (3H, d, J=7.0 Hz, CH_3-3), 3.13 (1H, m, H-3), 3.93 (1H, t, J=10.5 Hz, H-2a), 4.38 (1H, dd, J=10.5, 4.5 Hz, H-2b). Because of the presence of NOE from the signal at δ 7.15 to CH_3-3 (δ 1.32), two mutually coupled protons at δ 7.15 and 7.22 (each 1H, d, J=8.0 Hz) were assigned for H-4 and H-5, respectively. The NOE between H-5 and an aromatic methyl at δ 2.65 suggested this methyl group was attached to C-6. An olefinic methyl at δ 1.93 was located at C-9 due to the HMBC correlations of this methyl with C-9a (δ 162.9) which, in turn, showed HMBC with H-2 (δ 3.93, 4.38). The HMBC of CH_3-9 with C-8 (δ 201.1) inferred that a carbonyl carbon remained at C-8. The extra hydroxyl (δ 4.52, OH-7) and acetonyl substituents [δ_H 2.08 (3H, s, H-3′), 2.80 and 3.04 (each 1H, d, J=12.3 Hz, H-1′) and δ_C 32.1 (C-











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3′), 55.7 (C-1′), and 205.3 (C-2′)] were placed at C-7 because the hydroxyl and methylene H-1′ currently showed HMBC correlations with C-7 (δ 78.0), C-6a (δ 138.4), and C-8 (δ 201.1). The relative configurations of substituents at C-3 and C-7 were determined as follows. Owing to the large coupling constant 10.5 Hz of H-2_{ax} at δ 3.93 and the small coupling constant 4.5 Hz of H-2_{eq} at δ 4.38 with H-3 together with the NOE between H-3 (δ 3.13) and H-2_{eq} and the NOE between CH_3-3 (δ 1.32) and H-4 (δ 7.15), CH_3-3 should be in equatorial orientation. A strong NOE between H-1′ (δ 2.80, 3.04) and CH_3-6 suggested that the acetonyl group was positioned equatorially. Thus, the condensation product of mansonone E (**18**) and acetone with both equatorial CH_3-3 and CH_3COCH_2-7 was proposed to be the structure of hibiscuslide A (**1**).

Detailed analysis of the 1D and 2D NMR spectra of **2** inferred that the chemical shifts and coupling constants of H-2, H-3 and CH_3-3 were different from those of **1**. These differences were believed to be due to the different configuration at C-3. The absence of NOE between CH_3-3 [δ 1.29 (3H, d, J=7.3 Hz)] and H-4 [δ 7.06 (1H, d, J=7.9 Hz)] and the presence of NOE between H-1′ [δ 2.80 and 3.04 (each 1H, d, J=12.3 Hz)] and CH_3-6 [δ 2.64 (3H, s)] supported that CH_3-3 and acetonyl groups located toward axial and equatorial positions, respectively. The condensation product of mansonone E and acetone with axial CH_3-3 and equatorial CH_3COCH_2-7 was proposed to be the structure of hibiscuslide B (**2**). Therefore, compounds **1** and **2** were probably the artifacts produced from **18** during chromatographic separation using acetone. Their absolute configurations of **1** and **2** are under investigation.

Hibiscuslide C (**3**) was determined to have the molecular formula $C_{13}H_{12}O_4$ by high resolution EI-MS at *m*/*z* 232.0735 $[M]^+$. The UV spectrum at 243, 277, 360 nm suggested that compound **3** is a naphthalene derivative. In ^{1}H-NMR, COSY and NOESY spectra, an aromatic proton at δ 7.81 (1H, d, J=8.4 Hz, H-4) coupled with the proton at δ 6.94 (1H, d, J=8.4 Hz, H-3), showed NOE with another aromatic proton at δ 7.36 (s, H-5). The signals for substituents including a methyl at δ 2.40, a methoxyl at δ 3.78, an aldehyde at δ 11.05, and two hydroxyls at δ 6.28 and 13.84 were also observed. The location of these substituents was determined by NOESY spectrum. The methyl at δ 2.40 showed NOE with H-5 (δ 7.36) and methoxyl (δ 3.78), and the latter showed NOE with a hydroxyl at δ 6.28, indicating that the methyl, methoxyl and one of the hydroxyls were present at C-6, C-7, and C-8, respectively. The downfield hydroxyl signal at δ 13.84 indicated the presence of intramolecular hydrogen bonding with aldehydic carbonyl. The upfield-shift of H-3 (δ 6.94) inferred an electron-donating hydroxyl next to it. Therefore, the aldehyde group and the other hydroxyl group were located at C-1 and C-2, respectively. Based on the above analysis, the structure of 1-formyl-2,8-dihydroxy-7-methoxy-6-methylnaphthalene was deduced to be hibiscuslide C (**3**).

Hibiscutaiwanin (**4**) was isolated as colorless oil with the molecular formula $C_{14}H_{22}O_3$ by high resolution EI-MS at *m*/*z* 228.0786. The UV spectrum showed the maxima at 206, 226, 258, 282, and 323 nm indicated the presence of aromatic nucleus. The IR spectrum exhibited the hydroxyl and carbonyl absorptions at 3442 and 1732 cm^{-1}. The ^{1}H-NMR spectrum showed a methylene signal at δ 3.88 (s), an aldehyde signal at δ 9.98 (s), two hydroxyl signals at δ 8.24 and 10.82, and two sets of phenyl signals with A_2B_2 pattern at δ 6.75 (d, J=8.4 Hz, H-2′ and -6′) and 7.05 (d, J=8.4 Hz, H-3′ and -5′) and ABX pattern at δ 6.89 (d, J=8.6 Hz, H-5), 7.43 (dd, J=8.6, 2.0 Hz, H-6), and 7.57 (d, J=2.0 Hz, H-2). The NOEs of the aldehyde proton (δ 9.98) with H-2 (δ 7.57) and H-6 (δ 7.43) together with the methylene protons (δ 3.88) with H-2 and H-2′, -6′ (δ 6.75) suggested that two phenyl rings were connected through a methylene group and the aldehyde group was located at C-5. Consequently, hibiscutaiwanin (**4**)

Table 1. Anti-HIV Activity and Cytotoxicity for Compounds from *Hibiscus taiwanensis*

Compound	Inhibition of HIV replication in H9 lymphocytic cells			Cytotoxicity against human cancer cell lines,[e] EC_{50} (μg/ml)	
	IC_{50} (μg/ml)[a]	EC_{50} (μg/ml)[b]	TI[c]	A549	MCF-7
Hibicusin (**5**)	>25	NS[d]	NS	16.4	>20 (46)
Hibicuwanin A (**6**)	>25	NS	NS	>20 (14)	>20 (36)
Hibicuwanin B (**7**)	>25	NS	NS	>20 (28)	>20 (40)
(7*S*,8*S*)-Demethylcarolignan E (**8**)	16.64	NS	NS	9.7	8.3
erythro-Carolignan E (**10**)	17.86	NS	NS	10.6	8.5
9,9′-*O*-Feruloyl-(−)-secoisolaricinresinol (**12**)	17.05	NS	NS	1.8	3.9
Dihydrodehydrodiconifenyl alcohol (**13**)	>25	NS	NS	>20 (16)	>20 (48)
Boehmenan (**14**)	19.43	NS	NS	18.4	10.9
Cleomiscosin A (**16**)	18.63	NS	NS	>20 (22)	>20 (35)
Cleomiscosin C (**17**)	>25	NS	NS	>20 (33)	>20 (38)
Mansonone H (**19**)	>25	16.58	1.50	10.5	10.7
N-trans-Feruloyltyramine (**23**)	>25	NS	NS	>20 (24)	>20 (36)
2-(2-Hydroxytricosanoylamino)-1,3,4-hexadecanetriol (**25**)	Did not dissolve			>20 (15)	>20 (26)
Myriceric acid A (**27**)	24.99	NS	NS	>20 (42)	>20 (36)
Myriceric acid B (**28**)	17.29	NS	NS	8.2	10.4
Myriceric acid C (**29**)	14.95	NS	NS	3.9	4.1
Uncarinic acid A (**30**)	19.87	1.53	12.95	4.6	7.7
AZT	500	0.0007	737207		

a) Concentration that inhibits uninfected H9 cell growth by 50%. *b*) Concentration that inhibits viral replication by 50%. *c*) Therapeutic index=IC_{50}/EC_{50}. *d*) NS=no suppression. *e*) A549=human lung carcinoma; MCF-7=human breast carcinoma.

possessed the structure of 4-hydroxy-3-(4-hydroxybenzyl)-benzaldehyde.

Hibiscusin (**5**), colorless syrup, was determined to have the molecular formula $C_{48}H_{61}O_9$ by high resolution FAB-MS at *m/z* 781.4319 $[M+H]^+$. The UV, IR, ^{1}H- and ^{13}C-NMR spectral data were very closely related to those of myriceric acid C (**29**), a dicaffeate of myricerol, which was also isolated in this study. According to the ^{1}H- and ^{13}C-NMR, DEPT, COSY, NOESY, HMQC, and HMBC spectra of **5**, the main triterpene skeleton contained 6 methyls at δ 16.1 (C-25), 17.4 (C-24), 19.3 (C-26), 24.4 (C-30), 28.6 (C-23), and 33.8 (C-29), 11 methylenes at δ 19.4 (C-6), 24.4 (C-16), 24.6 (C-15), 25.1 (C-11), 28.6 (C-2), 34.2 (C-7), 34.4 (C-22), 35.3 (C-21), 39.4 (C-1), 47.1 (C-19), and 66.9 (C-27), 5 methines at δ 43.2 (C-18), 50.1 (C-9), 56.8 (C-5), 82.3 (C-3), and 127.0 (C-12), and 8 quaternary carbons at δ 31.7 (C-20), 38.3 (C-10), 39.0 (C-4), 41.2 (C-8), 46.8 (C-14), 48.4 (C-17), 140.1 (C-13), 185.4 (C-28). The only difference between **5** and **29** was that one of the caffeoyl group was replaced by the coumaroyl group due to the ^{1}H signals at δ 6.27 (1H, d, J=15.9 Hz, H-8″), 6.79 (2H, d, J=8.5 Hz, H-3″ and -5″), 7.43 (2H, d, J=8.5 Hz, H-2″ and -6″), and 7.57 (1H, d, J=15.9 Hz, H-7″). The ^{1}H–^{13}C long range correlation of H-3 [δ 4.52 (dd, J=15.3, 4.6 Hz)] with C-9″ (δ 169.3), and H-27 [δ 4.14 and 4.41 (d, J=12.5 Hz)] with C-9′ (δ 169.1) in HMBC spectrum ascertained the esterification of coumaric acid and caffeic acid with OH-3 and OH-27 of myricerol, respectively. Thus, 3-*O*-coumaroyl-27-*O*-caffeoylmyricerol was assigned for hibiscusin (**5**).

Compounds **5**, **6**—**8**, **10**, **12**, **13**, **14**, **16**, **17**, **19**, **23**, **25**, **27**—**30**, were subjected to cytotoxicity and anti-HIV evaluation. Among them, naphthoquinone **19** and triterpenoid **30** inhibited HIV replication in H9 lymphocyte cells with EC_{50} values of 16.58 and 1.53 μg/ml, and their therapeutic indexes (IC_{50}/EC_{50}) were 1.50 and 12.95, respectively. Furthermore, lignan **12** showed strong cytotoxic activity against human lung carcinoma (A549) and breast carcinoma (MCF-7). Triterpenoids **29** and **30** exhibited marginal cytotoxicity (Table 1).

Experimental

General Procedures Melting points were recorded on a Yanagimoto MP-S3 melting point apparatus and are uncorrected. Optical rotations were measured on a Jasco DIP-370 digital polarimeter. UV spectra were recorded on an Agilent 8453 spectrophotometer. IR spectra were measured on a Nicolet Magna FT-IR spectrophotometer. NMR spectra were recorded on Bruker Avance-300 and AMX-400 FT-NMR spectrometers; all chemical shifts were given in ppm from tetramethylsilane as an internal standard. Mass spectra were obtained on a Finnigan Trace and VG 70-250S spectrometer by a direct inlet system. CD spectra were determined on a JASCO J-700 spectropolarimeter.

Plant Material The stems of *Hibiscus taiwanensis* were collected from Tainan Hsien, Taiwan, Republic of China, in February 2001, and were authenticated by Professor C. S. Kuoh, Department of Biology, National Cheng Kung University, Tainan, Taiwan. A voucher specimen (No: PLW-010001) was deposited in the Herbarium of National Cheng Kung University.

Extraction and Isolation The air-dried stems of *Hibiscus taiwanensis* (20 kg) were powdered and extracted under reflux with MeOH 6 times. The combined extracts were concentrated under reduced pressure to give dark brown syrup (850 g). The syrup was then suspended in H_2O and defatted with hexane. The aqueous solution was partitioned with $CHCl_3$ and EtOAc, successively. The concentrated $CHCl_3$ layer (210 g) was fractionated on a silica gel column by eluting with a gradient of hexane and Me_2CO (3 : 1 to 100% Me_2CO) to obtain ten fractions. Fraction 2 was chromatographed on silica gel column with hexane–Me_2CO (19 : 1 to 1 : 1) to obtain **15** (36 mg), **39** (2 mg), **22** (1 mg), and **7** (10 mg). Fraction 3 was chromatographed on silica gel eluting with a gradient of hexane and Me_2CO (19 : 1 to 100% Me_2CO) to yield **34** (18 mg), **21** (2 mg), **1** (2 mg), **2** (3 mg), **45** (5 mg), **38** (2 mg), **18** (6 mg), **48** (3 mg), **50** (16 mg), **3** (1 mg), **51** (4 mg), **52** (28 mg), and **20** (4 mg). Fraction 4 was chromatographed on silica gel with hexane–Me_2CO (5 : 1) eluent to obtain **33** (23 mg), **53** (15 mg), **26** (24 mg), **43** (3 mg), **32** (5 mg). Fraction 5 was chromatographed on silica gel eluting with a gradient of hexane and Me_2CO (5 : 1 to 100% Me_2CO) to give **42** (12 mg), **12** (113 mg), **19** (62 mg), **14** (15 mg), **54** (5 mg), **30** (7 mg), **31** (2 mg), **11** (3 mg). Fraction 6 was further purified by silica gel column chromatography using a gradient of hexane and Me_2CO (5 : 1 to 100% Me_2CO) to give **10** (12 mg), **8** (528 mg), **16** (10 mg), **17** (38 mg). Fraction 7 was chromatographed on silica gel with hexane–Me_2CO (5 : 1) eluent to yield **36** (48 mg), **23** (486 mg), **24** (6 mg), **13** (8 mg). Fraction 8 was chromatographed on silica gel column using hexane–Me_2CO (5 : 1 to 100% Me_2CO) eluent to give **49** (2 mg), **4** (1 mg,), **44** (2 mg), **25** (20 mg), **55** (126 mg), and **56** (1.2 g). The concentrated EtOAc layer (32 g) was subjected to column chromatography on silica gel and eluted with a gradient of $CHCl_3$ and MeOH (9 : 1 to 100% MeOH) to give seven fractions. Fraction 2 was rechromatographed over silica gel column eluting with a gradient of $CHCl_3$ and MeOH (9 : 1 to 100% MeOH) to yield **47** (53 mg), **46** (2 mg), **35** (10 mg), **27** (4 mg), **28** (50 mg), **29** (16 mg), **5** (5 mg), **9** (17 mg). Fraction 3 was chromatographed on silica gel column eluting with a gradient of $CHCl_3$ and MeOH (9 : 1 to 100% MeOH) to give **40** (11 mg), **41** (2 mg), **6** (5 mg), **7** (8 mg).

Hibicuslide A (**1**): Yellow syrup. ^{1}H-NMR ($CDCl_3$) δ: 1.32 (3H, d, J=7.0 Hz, CH_3-3), 1.93 (3H, s, CH_3-9), 2.08 (3H, s, H-3′), 2.65 (3H, s, CH_3-6), 2.80 (1H, d, J=12.3 Hz, H-1′a), 3.04 (1H, d, J=12.3 Hz, H-1′b), 3.13 (1H, m, H-3), 3.93 (1H, t, J=10.5 Hz, H-2a), 4.38 (1H, dd, J=10.5, 4.5 Hz, H-2b), 4.52 (1H, s, OH-7), 7.15 (1H, d, J=8.0 Hz, H-4), 7.22 (1H, d, J=8.0 Hz, H-5). ^{13}C-NMR ($CDCl_3$) δ: 7.7 (CH_3-9), 15.4 (CH_3-3), 21.5 (CH_3-6), 31.2 (C-3), 32.1 (C-3′), 55.7 (C-1′), 71.5 (C-2), 78.0 (C-7), 109.1 (C-9), 125.0 (C-4), 134.5 (C-5), 136.1 (C-3a, -6), 138.4 (C-6a, -9b), 162.9 (C-9a), 201.1 (C-8), 205.3 (C-2′). IR (film) cm^{-1}: 3350, 1719, 1705, 1612, 1580. UV λ_{max} (CH_3OH) nm (log ε): 246 (3.37), 254 (3.34), 332 (3.19). HR-EI-MS *m/z*: 300.1361 $[M]^+$ (Calcd for $C_{18}H_{20}O_4$, 300.1362). EI-MS *m/z*: 300 (M^+), 243 (92), 215, 199, 187, 171, 152, 141, 128, 115, 91, 77. $[\alpha]_D$ +15.0° (c=0.10, CH_3OH).

Hibicuslide B (**2**): Yellow syrup. ^{1}H-NMR ($CDCl_3$) δ: 1.29 (3H, d, J=7.3 Hz, CH_3-3) 1.94 (3H, s, CH_3-9), 2.09 (3H, s, H-3′), 2.64 (3H, s, CH_3-6), 2.80 (1H, d, J=12.3 Hz, H-1′a), 3.04 (1H, d, J=12.3 Hz, H-1′b), 3.05 (1H, m, H-3), 4.30 (2H, m, H-2), 4.52 (1H, s, OH-7), 7.06 (1H, d, J=7.9 Hz, H-4), 7.19 (1H, d, J=7.9 Hz, H-5). ^{13}C-NMR ($CDCl_3$) δ: 7.8 (CH_3-9), 19.1 (CH_3-3), 21.5 (CH_3-6), 32.2 (C-3′), 32.6 (C-3), 55.8 (C-1′), 71.2 (C-2), 78.1 (C-7), 108.5 (C-9), 126.8 (C-4), 134.6 (C-5), 136.2 (C-3a, -6), 138.4 (C-6a, -9b), 162.3 (C-9a), 201.0 (C-8), 205.3 (C-2′). IR (flim) cm^{-1}: 3445, 1703, 1621, 1584. UV λ_{max} (CH_3OH) nm (log ε): 246 (3.82), 253 (3.77), 336 (3.70). HR-EI-MS *m/z*: 300.1360 $[M]^+$ (Calcd for $C_{18}H_{20}O_4$, 300.1362). EI-MS *m/z*: 300 (M^+), 243, 215, 199, 187, 128, 115, 91, 77. $[\alpha]_D$ +77.0° (c=0.13, CH_3OH).

Hibicuslide C (**3**): Colorless oil. ^{1}H-NMR ($CDCl_3$) δ: 2.40 (3H, s, 6-CH_3), 3.78 (3H, s, 7-OCH_3), 6.28 (1H, s, OH-8), 6.94 (1H, d, J=8.4 Hz, H-3), 7.36 (1H, s, H-5), 7.81 (1H, d, J=8.4 Hz, H-4), 11.05 (1H, s, CHO-1), 13.84 (1H, s, OH-2). IR (film) cm^{-1}: 3273, 1622, 1479. UV λ_{max} (CH_3OH) nm (log ε): 243 (3.92), 277 (3.17), 360 (3.58). HR-EI-MS *m/z*: 232.0735 $[M]^+$ (Calcd for $C_{13}H_{12}O_4$, 232.0736). EI-MS *m/z*: 232 (M^+), 217, 161, 131, 115, 105, 77.

Hibicutaiwanin (**4**): Colorless oil. ^{1}H-NMR (acetone-d_6) δ: 3.88 (2H, s, CH_2), 6.75 (2H, d, J=8.4 Hz, H-2′, -6′), 6.89 (1H, d, J=8.6 Hz, H-5), 7.05 (2H, d, J=8.4 Hz, H-3′, -5′), 7.43 (1H, dd, J=8.6, 2.0 Hz, H-6), 7.57 (1H, d, J=2.0 Hz, H-2), 8.24 (1H, s, OH), 9.98 (1H, s, CHO-1), 10.82 (1H, s, OH). IR (film) cm^{-1}: 3442, 1732, 1652, 1595, 1514. UV λ_{max} (CH_3OH) nm (log ε): 206 (4.23), 226 (3.91), 258 (3.34), 282 (3.36), 323 (3.30). HR-EI-MS *m/z*: 228.0786 $[M]^+$ (Calcd for $C_{14}H_{12}O_3$, 228.0786). EI-MS *m/z*: 228 (M^+), 199, 181, 152, 115, 107, 77.

Hibicusin (**5**): White powder: mp 211—213 °C. ^{1}H-NMR (CD_3OD) δ: 0.81 (3H, s, H-29), 0.88 (3H, s, H-23), 0.89 (3H, s, H-26), 0.94 (6H, H-24, -30), 0.99 (3H, s, H-25), 3.00 (1H, br d, J=11.2 Hz, H-18), 4.14 (1H, d, J=12.5 Hz, H-27a), 4.41 (1H, d, J=12.5 Hz, H-27b), 4.52 (1H, dd, J=15.3, 4.6 Hz, H-3), 5.57 (1H, br s, H-12), 6.17 (1H, d, J=15.9 Hz, H-8′), 6.27 (1H, d, J=15.9 Hz, H-8″), 6.78 (1H, d, J=8.3 Hz, H-5′), 6.79 (2H, d, J=8.5 Hz, H-3″, -5″), 6.91 (1H, d, J=8.3 Hz, H-6′), 7.02 (1H, br s, H-2′), 7.43 (2H, d, J=8.5 Hz, H-2″, -6″), 7.51 (1H, d, J=15.9 Hz, H-7′), 7.57 (1H, d, J=15.9 Hz, H-7″). ^{13}C-NMR (CD_3OD) δ: 16.1 (C-25), 17.4 (C-24), 19.3 (C-26), 19.4 (C-6), 24.4 (C-16, -30), 24.6 (C-15), 25.1 (C-11), 28.6 (C-2, -23), 31.7 (C-20), 33.8 (C-29), 34.2 (C-7), 34.4 (C-22), 35.3 (C-21), 38.3 (C-10),

39.0 (C-4), 39.4 (C-1), 41.2 (C-8), 43.2 (C-18), 46.8 (C-14), 47.1 (C-19), 48.4 (C-17), 50.1 (C-9), 56.8 (C-5), 66.9 (C-27), 82.3 (C-3), 115.0 (C-2′), 115.4 (C-8′), 115.5 (C-8″), 116.7 (C-5′), 116.9 (C-3″, -5″), 122.9 (C-6′), 127.0 (C-12), 127.5 (C-1′), 131.1 (C-2″, -6″), 133.4 (C-1″), 140.1 (C-13), 146.4 (C-7″), 146.9 (C-7′), 147.0 (C-3′), 150.0 (C-4′), 161.5 (C-4″), 169.1 (C-9′), 169.3 (C-9″), 185.4 (C-28). IR (KBr) cm^{-1}: 3365, 1682, 1603, 1516. UV λ_{max} (CH_3OH) nm (log ε): 205 (4.96), 315 (4.32). HR-FAB-MS *m*/*z*: 781.4319 $[M+H]^+$ (Calcd for $C_{48}H_{61}O_9$, 781.4316). FAB-MS *m*/*z*: 781 ($[M+H]^+$), 330. $[\alpha]_D$ +31.7° (*c*=0.32, CH_3OH).

Cytotoxicity and Anti-HIV Assay The cytotoxicity and anti-HIV assay was carried out according to the procedure described in the literature.[15)]

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