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NEW KEHOKORINS AND TRICHIOLS FROM THE MYXOMYCETE *TRICHIA FAVOGINEA*

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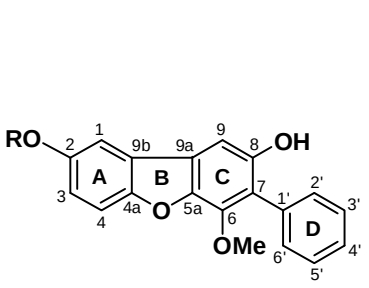
Abstract – Two new dibenzofurans, kehokorins D (**1**) and E (**2**), and two new sterols with a 2,6-dioxabicyclo[2.2.2]octan-3-one ring, trichiols C (**3**) and D (**4**), have been isolated from field-collected fruiting bodies of the myxomycete, *Trichia favoginea*, and their structures were elucidated by spectral analysis. Kehokorins D (**1**) and E (**2**) showed cell growth inhibition activity against HeLa cells with IC_{50} values of 6.1 and 4.5 μg/mL, respectively.

INTRODUCTION

During our studies on bioactive natural products from myxomycetes,[1,2] we have reported the isolation and structural elucidation of three new dibenzofurans, kehokorins A – C (**5** - **7**),[3] and two new sterols with a 2,6-dioxabicyclo[2.2.2]octan-3-one ring, trichiols A (**8**) and B (**9**),[4,5] from field-collected samples of fruiting bodies of *Trichia favoginea* var. *persimilis* from Kochi prefecture in Japan. Recently we investigated a different material of myxomycetes identified as *Trichia favoginea*. *Trichia favoginea* var. *persimilis*, which we studied previously,[3,4] was a variant species of *Trichia favoginea*. It was demonstrated that *Trichia favoginea* contained four different new natural products from those contained in *Trichia favoginea* var. *persimilis*. Here we describe the isolation and structural elucidation of the four new compounds, kehokorins D (**1**) and E (**2**) and trichiols C (**3**) and D (**4**). Kehokorins D (**1**) and E (**2**) showed cell growth inhibition activity against HeLa cells with IC_{50} values of 6.1 and 4.5 μg/mL, respectively.

RESULTS AND DISCUSSION

The fruiting bodies of *Trichia favoginea*, collected in Kochi Prefecture, Japan, were extracted with 90 %



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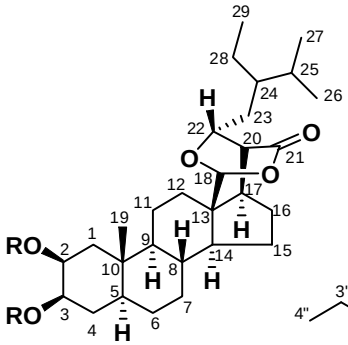

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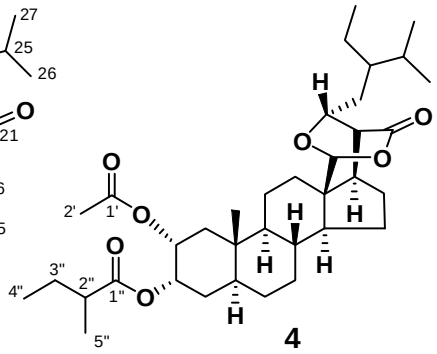

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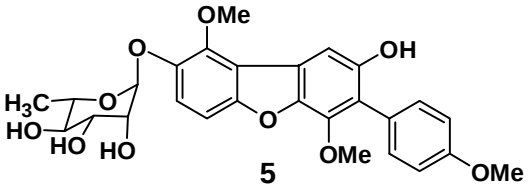

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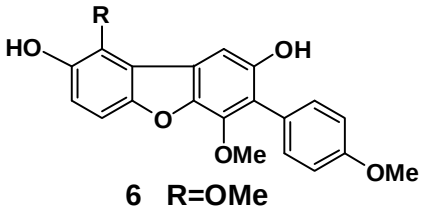

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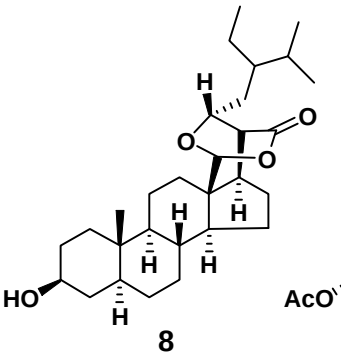
7 R=H



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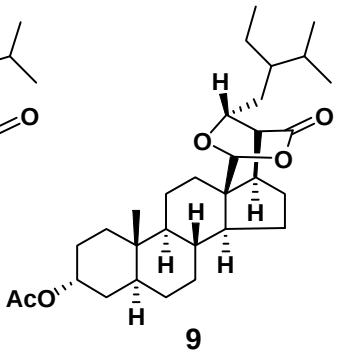

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MeOH and 90% acetone. The combined extracts were subjected to silica gel chromatography, followed by fractionations by Sephadex LH-20 and ODS columns to give four new compounds, kehokorins D (**1**) and E (**2**) and trichiols C (**3**) and D (**4**).

Kehokorin D (**1**) was shown to have a molecular formula of $C_{19}H_{14}O_4$ from HRFABMS data (*m/z* 306.0894 $[M]^+$, Δ +0.2 mmu). Its UV spectrum showed absorption maxima at 306 and 264 nm, indicating the presence of a conjugated or aromatic system(s), and its IR absorption band at 3420 cm^{-1} suggested the presence of hydroxyl group(s). The ^1H and ^{13}C NMR spectral data of **1** were similar to those of kehokorins A – C (**5** - **7**).[3] The ^{13}C NMR spectrum of **1** (Table 1) gave signals due to eighteen sp^2 carbons and one *O*-methyl carbon (δ_C 60.8). The ^1H NMR spectrum of **1** (Table 1) showed signals for one methoxy group at δ_H 4.03 (3H, s) and aromatic hydrogens on three benzene rings, which were assignable to one monosubstituted [δ_H 7.45 (3H, m; H-2', H-4', and H-6') and 7.55 (2H, t, *J*=7.5 Hz; H-3' and H-5')], one trisubstituted [δ_H 7.32 (1H, d, *J*=2.5 Hz; H-1), 6.96 (1H, dd, *J*=8.5 and 2.5 Hz; H-3), and 7.42 (1H, d, *J*=8.5 Hz; H-4)], and one pentasubstituted [δ_H 7.18 (1H, s; H-9)] benzenes with the aid of interpretation of the ^1H-^1H COSY and the HMBC spectra of **1**. The trisubstituted benzene (ring A) was constructed by the HMBC correlations observed for H-1/C-2, H-1/C-3, H-1/C-4a, H-3/C-1, H-3/C-4a, H-4/C-2, and H-4/C-9b, while the presence of the pentasubstituted benzene (ring C) was suggested by the

Table 1. ^{1}H and ^{13}C NMR Spectral Data of Kehokorins D (**1**) and E (**2**) in $CDCl_3$

position	**1**			**2**		
	δ_H	*J* in Hz	δ_C	δ_H	*J* in Hz	δ_C
1	7.32	d 2.5	106.2	7.36	d 2.5	103.5
2			151.5			155.7
3	6.96	dd 8.5, 2.5	115.6	7.05	dd 8.5, 2.5	115.4
4	7.42	d 8.5	112.2	7.46	d 8.5	112.0
4a			151.4			151.4
5a			142.8			142.7
6			142.4			142.4
7			120.2			120.0
8			149.1			149.1
9	7.18	s	100.1	7.21	s	99.8
9a			125.1			126.1
9b			125.8			124.7
1'			132.5			132.6
2'	7.45	m	130.7	7.45	m	130.5
3'	7.55	t 7.5	129.3	7.55	t 7.5	129.0
4'	7.45	m	128.4	7.45	m	128.2
5'	7.55	t 7.5	129.3	7.55	t 7.5	129.0
6'	7.45	m	130.7	7.45	m	130.5
2-OMe				3.92	s	55.9
6-OMe	4.03	s	60.8	4.02	s	60.6
8-OH				4.92	s	

HMBC correlations from H-9 to C-5a, C-7, and C-8. Low-field resonance of five carbons for C-2 (δ_C 151.5), C-4a (δ_C 151.4), C-5a (δ_C 142.8), C-6 (δ_C 142.4), and C-8 (δ_C 149.1) implied that these carbons bore oxygen atoms. The methoxy group was suggested to be on C-6 from the HMBC connectivity observed from the methoxy protons (δ_H 4.03) to C-6 (δ_C 142.4), while the HMBC spectrum showed correlation from H-9 to C-9b, suggesting that ring A and ring C were connected at the C-9a and C-9b positions. The monosubstituted benzene ring (ring D) was shown to be located on the C-7 position by the HMBC correlations from H-2'(6') (δ_H 7.45) to C-7 (δ_C 120.2). Since twelve out of thirteen unsaturation equivalents were accounted for by the presence of three benzene rings, compound **1** was inferred to possess another ring, which was suggested to be an ether ring located between the C-4a and C-5a positions, constructing a dibenzofuran nucleus for the basic skeleton of compound **1**, and two remaining oxygenated carbons at C-2 and C-8 were suggested to bear hydroxyl groups. Thus, the whole structure of kehokorin D was elucidated as **1**, and this structure proved to correspond to the 4'-demethoxy derivative of kehokorin C (**7**).[3]

Kehokorin E (**2**) had a molecular formula of $C_{20}H_{16}O_4$ as shown by HRFABMS data (*m/z* 320.1047 [M^+], Δ -0.2 mmu), having one CH_2 unit more than kehokorin D (**2**). The ^{1}H and ^{13}C NMR spectral data of **2** (Table 1) as well as its UV and IR spectra were almost parallel to those of compound **1**, except for the

fact that the ^{1}H NMR signals due to two methoxy groups [δ_H 4.02 (3H, s) and 3.92 (3H, s)] were observed for compound **2**, while **1** had only one methoxy group. The ^{1}H-^{1}H COSY, HMQC, and HMBC data suggested that kehokorin E (**2**) had the same backbone skeleton as kehokorin D (**1**) and one hydroxyl group of **1** was replaced by a methoxy group in **2**. The HMBC spectrum of **2** showed correlations from the *O*-methyl protons [δ_H 4.02 (3H, s) and 3.92 (3H, s)] to the sp^2-quaternary carbon on C-6 (δ_C 142.4) and C-2 (δ_C 155.7), respectively. C-2 (δ_C 155.7) showed HMBC correlations with not only the methoxy group but also H-1 (δ_H 7.36, d, *J*=2.5 Hz) and H-4 (δ_H 7.46, d, *J*=8.5 Hz). The hydroxy proton on C-8 (8-O<u>H</u>) resonated at δ_H 4.92, which showed HMBC correlation with C-9 (δ_C 99.8). From these results, kehokorin E (**2**) was concluded to be a 2-*O*-methyl derivative of kehokorin D (**1**).

Trichiol C (**3**) showed a quasi-molecular ion peak at *m/z* 475 $(M+H)^+$ in its positive FAB mass spectrum, and its molecular formula was revealed as $C_{29}H_{46}O_5$ from HRFABMS data [*m/z* 475.3412, $(M+H)^+$, Δ –1.2 mmu]. The IR absorption bands at 3420 and 1775 cm^{-1} indicated the presence of hydroxy and carbonyl groups, and no particular UV absorption was observed for **3**. Trichiol C (**3**) had a molecular formula with one oxygen atom more than that of trichiol A (**8**).[4,5] The ^{1}H and ^{13}C NMR spectral data of trichiol C (**3**) (Table 2) were almost parallel to those of trichiol A (**8**)[4], except for the fact that **3** showed ^{1}H and ^{13}C NMR signals due to one more oxymethine (δ_H 4.02 br s; δ_C 69.8) than **8**. Analysis of the ^{1}H-^{1}H COSY, HMQC, and HMBC data of **3** suggested that **3** had the same backbone skeleton as **8**, containing the unique 2,6-dioxabicyclo[2.2.2]octan-3-one ring structure [for **3**: δ_H 5.73 s (H-18), 2.65 dd *J*=4.0 and 1.7 Hz (H-20), and 4.09 dt *J*=7.0 and 1.3 Hz (H-22); δ_C 100.1 (C-18), 46.1 (C-20), 173.1 (C-21), and 72.5 (C-22)]. The ^{1}H-^{1}H COSY spectrum showed the proton connectivities from H_2-1 to H-5 (H_2-1/H-2/H-3/H_2-4/H-5) and suggested that the two oxymethine carbons were located vicinally on ring A at C-2 (δ_H 4.02 br s; δ_C 69.8) and C-3 (δ_H 3.64 dt, *J*=11.5 and 4.0 Hz; δ_C 72.2), which was consistent with the HMBC correlations observed from H_2-1 (δ_H 1.12 and 2.02) to C-2 and C-3 and from H_2-4 (δ_H 0.93 and 1.38) to C-3. Thus, trichiol C (**3**) was suggested to bear two secondary hydroxyl groups on C-2 and C-3, which was further confirmed by preparation of diacetate [**10**, FABMS: *m/z* 559 $(M+H)^+$; δ_H 2.00 and 2.08 (each 3H, s)] from **3** by treatment with Ac_2O and pyridine. The ^{1}H NMR signal of **3** due to H-2 was observed as a broad singlet, implying that the *J*-values between H-2 and neighboring hydrogens were small, while H-3 appeared as a doublet of triplets with *J*-values of 11.5 and 4.0 Hz, respectively, indicating *J*(H-2, H-3)=4.0 Hz, *J*(H-3, H-4$_{equatorial}$)=4.0 Hz, and *J*(H-3, H-4$_{axial}$)=11.5 Hz. Thus, it was suggested that H-2 was equatorial and H-3 was axial, *viz.* hydroxyl groups on C-2 and C-3 were β-axial and β-equatorial, respectively. From these results, the structure of trichiol C (**3**) was concluded as 2 β-hydroxytrichiol A.

The molecular formula of trichiol D (**4**) was revealed as $C_{36}H_{56}O_7$ from HRFABMS data [*m/z* 601.4069, $(M+H)^+$, Δ –3.5 mmu], having a $C_7H_{10}O_2$ unit more than that of trichiol C (**3**). The ^{1}H and ^{13}C NMR

Table 2. ^{1}H and ^{13}C NMR Data of Trichiol C (**3**) and Trichiol D (**4**) in $CDCl_3$[a]

positions	**3**		**4**	
	δ_H (*J* in Hz)	$\delta\delta_C$	δ_H (*J* in Hz)	δ_C
1	1.12 m and 2.02 m	42.7	1.25 m and 1.99 m	40.8
2	4.02 br s	69.8	5.25 dt (11.0, 3.0)	69.7
3	3.64 dt (11.5, 4.0)	72.2	4.81 br s	71.8
4	0.93 m and 1.38 m	32.2	1.46 m and 1.82 m	29.2
5	1.15 m	45.3	1.28 m	45.3
6	1.48 m and 1.70 m	32.1	0.98 m and 1.26 m	32.0
7	1.32 m and 1.78 m	33.9	1.30 m and 1.38 m	27.7
8	1.67 m	34.7	1.70 m	33.9
9	0.81 m	55.9	0.87 m	55.6
10		35.7		35.6
11	1.44 m and 1.68 m	21.7	1.42 m and 1.64 m	21.7
12	1.44 m and 2.36 m	35.6	1.42 m and 2.36 m	35.4
13		48.1		48.1
14	1.42 m	56.6	1.45 m	56.4
15	1.52 m (2H)	26.1	1.52 m (2H)	26.1
16	1.62 m and 1.87 m	30.0	1.62 m and 1.86 m	30.1
17	2.38 dd (9.5, 4.0)	36.4	2.39 dd (9.9, 3.9)	36.4
18	5.73 s	100.1	5.70 s	100.2
19	1.03 s (3H)	14.2	0.99 s (3H)	14.2
20	2.65 dd (4.0, 1.7)	46.1	2.65 dd (3.9, 1.7)	46.2
21		173.1		173.1
22	4.09 dt (7.0, 1.3)	72.5	4.08 dt (6.9, 1.3)	72.5
23	1.52 m and 1.70 m	31.5	1.48 m and 1.72 m	31.6
24	1.18 m	41.6	1.18 m	41.7
25	1.78 m	28.1	1.78 m	28.1
26	0.82 d (7.0) (3H)	18.6	0.81 d (6.6) (3H)	18.6
27	0.86 d (7.0) (3H)	18.7	0.87 d (7.2) (3H)	19.0
28	1.22 m and 1.36 m	22.7	1.22 m and 1.38 m	22.5
29	0.87 t (7.0) (3H)	11.9	0.87 t (7.0) (3H)	11.7
1’				170.3
2’			2.07 s (3H)	21.1
1”				175.8
2”			2.30 m	41.7
3”			1.36 m and 1.63 m	26.1
4”			0.88 t (7.3) (3H)	11.7
5”			1.10 d (7.2) (3H)	16.3

[a)]Assignments were based on the 2D NMR (^{1}H-^{1}H COSY, HMQC, and HMBC) data as well as comparison with the data of trichiols A (**8**) and B (**9**).[4]

spectral data of **4** (Table 2) were almost parallel to those of compound **3**. However, signals due to one singlet (δ_H 2.07, 3H, s), one doublet (δ_H 1.10, 3H, d, *J*=7.2 Hz), and one triplet (δ_H 0.88, 3H, t, *J*=7.3 Hz) methyl group was additionally observed in the ^{1}H NMR of **4**, compared with that of **3**. The ^{1}H-^{1}H COSY and HMBC spectra of **4** suggested that C-2 and C-3 positions in ring A of **4** were also oxygenated as in the case of compound **3** (^{1}H-^{1}H COSY correlations: H_2-1/H-2/H-3/H_2-4/H-5; HMBC correlations: H_2-1/C-2, H_2-1/C-3, and H_2-4/C-3). However, the oxymethine protons on C-2 and C-3 resonated at a relatively lower field for **4** [δ_H 5.25 (H-2) and δ_H 4.81 (H-3); for **3**, δ_H 4.02 (H-2) and δ_H 3.64 (H-3)], implying that both of these oxymethine carbons were acylated. Analysis of the ^{1}H-^{1}H COSY, HMQC, and HMBC data of **4** suggested that these two acyl groups are acetyl and 2-methylbutanoyl groups, which

were attached at the C-2 and C-3 positions of **4**, respectively, on the basis of the HMBC correlation data [for acetyl group on C-2: H-2/C-1' and H_3-2'/C-1'; for 2-methylbutanoyl group on C-3: H-3/C-1", H-2"/C-1", H-2"/C-3", H_2-3"/C-2", H_2-3"/C-4", H_3-4"/C-2", H_3-4"/C-3", H_3-5"/C-1", H_3-5"/C-2", and H_3-5"/C-3"]. From these data, it was suggested that the planar structure of **4** corresponded to a 2-*O*-acetyl-3-*O*-2-methylbutanoyl derivative of trichiol C (**3**), while the stereochemistry at the C-2 and C-3 positions of **4** was different from those of **3** as shown from the following observations. The oxymethine proton (H-3) appeared as a broad singlet, implying that the *J*-values between H-3 and vicinal protons were small, whereas H-2 was observed as a doublet of triplets with *J*-values of 11.0 and 3.0 Hz, respectively, indicating J(H-1_{axial}, H-2)= 11.0 Hz, J(H-$1_{equatorial}$, H-2)= 3.0 Hz, and J(H-2, H-3)=3.0 Hz. These findings suggested that H-2 had a β-axial orientation and H-3 was β-equatorial, which was reminiscent of the fact that H-3 of trichiol B (**9**),[4,5] previously isolated from a variant species of *Trichia favoginea* var. *persimilis*, had a β-equatorial orientation with an α-axial acetoxy group on C-3. Thus, trichiol D (**4**) was revealed to be a 2-*O*-acetyl-3-*O*-2-methylbutanoyl derivative of a diastereomer at the C-2 and C-3 positions of trichiol C (**3**), viz. 2α-acetoxy-3-*O*-deacetyl-3-*O*-2-methylbutanoyltrichiol B.[4,5] Kehokorins D (**1**) and E (**2**) showed cell growth inhibition activity against the HeLa human epithelial carcinoma cell line with IC_{50} values of 6.1 and 4.5 μg/mL, respectively, while they both showed only weak inhibition activity against human colon carcinoma DLD1 cells (IC_{50}: >8 μg/mL). Trichiol C (**3**) showed a moderate cell growth inhibition activity against HeLa cells with an IC_{50} value of 14.1 μg/mL, but trichiol D (**4**) was inactive (IC_{50}: >25 μg/mL).

EXPERIMENTAL

General Procedures Optical rotation was measured with a JASCO P-1020 polarimeter. IR spectra were measured using a Hitachi 260-10 infrared spectrophotometer. NMR spectra were recorded on JEOL JNM ecp600 spectrometers. HR-FAB-MS were acquired on a JMS HX-110 mass spectrometer.

Organism The fruiting bodies of *Trichia favoginea* were collected in Kochi Prefecture, Japan, in October-November 2004. Voucher specimens (#27213, 27215, and 27398) are maintained by Y. Y. (Ohtsu-ko, Kochi).

Extraction and isolation The air-dried fruiting bodies of *Trichia favoginea* (6.5 g) were extracted with 90% MeOH (140 mL x 3) and 90% acetone (120 mL x 1) at rt. The combined extracts (0.5 g) were subjected to silica gel column chromatography (column A; 25 x 200 mm) with gradient elution of 0-100% MeOH in $CHCl_3$. A fraction (18 mg) of column A eluted with $CHCl_3$/MeOH (98:2) was further separated by Sephadex LH-20 column chromatography (15 x 60 mm) eluted with $CHCl_3$/MeOH (1:1) to give kehokorin D (**1**, 1.0 mg). Another fraction (25 mg) of column A eluted with $CHCl_3$/MeOH (98:2) was further purified by Sephadex LH-20 column (15 x 580 mm) eluted with MeOH, followed by ODS

column chromatography (8 x 300 mm; 85% MeOH) and Sephadex LH-20 column chromatography (8 x 350 mm) eluted with $CHCl_3$/MeOH (1:1) to give trichiol C (**3**, 1.5 mg). A fraction (8.5 mg) of column A eluted with 100% $CHCl_3$ was further purified by Sephadex LH-20 column (column B; 15 x 600 mm) eluted with $CHCl_3$/MeOH (1:1) to give kehokorin E (**2**, 2.8 mg). A fraction of column B (1.7 mg) was further purified by silica gel column chromatography eluted with hexane/EtOAc (10:1) to afford trichiol D (**4**, 0.9 mg).

Kehokorin D (1): amorphous powder; UV λ_{max} (MeOH) 306 (ε 18000) and 264 (ε 11000); IR (film) ν_{max} 3420 and 1610 cm^{-1}; ^1H and ^{13}C NMR (Table 1); FABMS *m/z* 306 (M^+); HRFABMS (positive) *m/z* 306.0894 [calcd for $C_{19}H_{14}O_4$, (M^+) 306.0892].

Kehokorin E (2): amorphous powder; UV λ_{max} (MeOH) 306 (ε 23000) and 263 (ε 14000); IR (film) ν_{max} 3420 and 1610 cm^{-1}; ^1H and ^{13}C NMR (Table 1); FABMS *m/z* 321 $(M+H)^+$; HRFABMS (positive) *m/z* 320.1047 [calcd for $C_{20}H_{16}O_4$, (M^+) 320.1049].

Trichiol C (3): amorphous powder; $[\alpha]_D^{26}$ +85 (*c* 0.1, MeOH); IR (film) ν_{max} 3420 and 1775 cm^{-1}; ^1H and ^{13}C NMR (Table 2); FABMS *m/z* 475 $(M+H)^+$; HRFABMS (positive) *m/z* 475.3412 [calcd for $C_{20}H_{17}O_4$, $(M+H)^+$ 475.3424].

Trichiol D (4): amorphous powder; $[\alpha]_D^{26}$ +36 (*c* 0.1, MeOH); IR (film) ν_{max} 1775, 1740, and 1655 cm^{-1}; ^1H and ^{13}C NMR (Table 2); FABMS *m/z* 601 $(M+H)^+$ and 639 $(M+K)^+$; HRFABMS (positive) *m/z* 601.4069 [calcd for $C_{36}H_{57}O_7$, $(M+H)^+$ 601.4104].

Acetylation of Trichiol C (3). Trichiol C (**3**, 0.7 mg) was treated with Ac_2O (0.1 mL) and pyridine (0.1 mL) at rt overnight. Evaporation of the reagent by a stream of nitrogen followed by purification with silica gel column chromatography (8 x 80 mm; hexane/EtOAc, 3:1) afforded diacetate (**10**, 0.5 mg): ^1H NMR ($CDCl_3$) δ_H 5.27 (1H, br s, H-2), 4.81 (1H, dt, *J*=11.0 and 3.0 Hz; H-3), 4.08 (1H, dt, *J*=7.0 and 1.3 Hz; H-22), 2.65 (1H, dd, *J*=4.2 and 1.7 Hz; H-20), 2.40 (1H, dd, *J*=9.8 and 3.7 Hz; H-17), 2.08 and 2.00 (each 3H, s; CH_3CO- x 2), 1.00 (3H, s; H_3-19), 0.87 (3H, t, *J*=7.0 Hz; H_3-29), 0.86 (3H, d, *J*=7.0 Hz; H_3-27), 0.82 (3H, d, *J*=7.0 Hz; H_3-26); FABMS *m/z* 559 $(M+H)^+$.

Cell Growth Inhibitory Activity The procedure of the assay was the same as described previously.[7] Briefly, HeLa cells (6×10^3 cells) were treated with different concentrations of each isolated compound for 24 h at 37 °C. After the medium containing the isolated compounds was removed, cell growth inhibitory activity was determined by the FMCA method[8] using a fluorescence platereader.

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REFERENCES AND NOTES

1. M. Ishibashi, *Med. Chem.*, 2005, **1**, 575.
2. M. Ishibashi, 'Studies in Natural Products Chemistry,' Vol. 29, ed. by Atta-ur-Rahman, Elsevier, Amsterdam, 2003, pp. 223-262.
3. K. Kaniwa, T. Ohtsuki, Y. Yamamoto, and M. Ishibashi, *Tetrahedron Lett.*, 2006, **47**, 1505.
4. K. Kaniwa, T. Ohtsuki, T. Sonoda, Y. Yamamoto, M. Hayashi, K. Komiyama, and M. Ishibashi, *Tetrahedron Lett.*, 2006, **47**, 4351.
5. Here we rename trichiol (**8**)[4] as trichiol A and 3-epitrichiol acetate (**9**)[4] as trichiol B.
6. The IC_{50} values of kehokorins A (**5**) ~ C (**7**) and trichiol A (**8**) and B (**9**) against the HeLa cells were 1.5, 7.2, >8.4, 6~12, and >12.5μg/mL, respectively.[3,4]
7. T. Ohtsuki, M. Sato, T. Koyano, T. Kowithayakorn, N. Kawahara, Y. Goda, and M. Ishibashi, *Bioorg. Med. Chem.*, 2006, **14**, 659.
8. R. Larsson, J. Kristensen, C. Sandberg, and P. Nygren, *Int. J Cancer*, 1992, **50**, 177.