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Three New Taxane Diterpenoids from the Seeds of *Taxus yunnanensis* Cheng et L. K. Fu and *T. cuspidata* Sieb et Zucc

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Abstract: Chemical examination of the seeds of the Chinese yew, *Taxus yunnanensis* Cheng et L. K. Fu and Japanese yew, *T. cuspidata* Sieb et Zucc resulted in the isolation of three new and rare rearranged *abeo*taxane type of diterpenoids in addition to several known compounds. The structures of the new taxoids have been established as 9α,13α-diacetoxy-11(15→1)*abeo*taxa-4(20),11-diene-5α,10β,15-triol (**1**), 9α,13α-diacetoxy-10β-benzoyloxy-5α-(3'-dimethylamino-3'-phenyl)-propionyloxy-11(15→1)*abeo*taxa-4(20),11-diene-15-ol (**2**), and 2α,7β,13α-triacetoxy-10β-hydroxy-5α-(3'-dimethylamino-3'-phenyl)-propionyloxy-2(3→20)-*abeo*-taxa-9-one (**3**) by a study of their spectral data.

In view of the demonstrated clinical effectiveness of Taxol® (paclitaxel) in ovarian, breast and other carcinomas, there have been intensive efforts to search for other members of the taxane group, which may either

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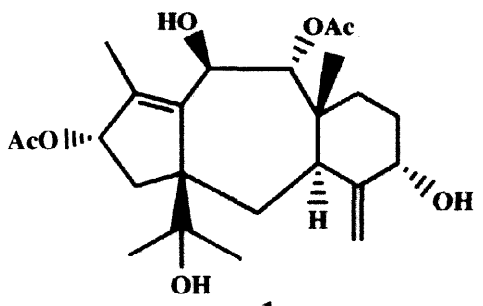
be directly active, or serve as precursors for the semisynthesis of other active analogs. This has led to the isolation of more than 200 taxane diterpenoids[1,2] and there are still great number of new taxoids being isolated.[3-6] In previous studies we have reported on the isolation of several new taxoids from the bark and needles of *T. chinensis* var. *mairei* Cheng et L. K. Fu.[7-14] Our continuing investigation on the seeds of the Chinese yew *Taxus yunnanensis* Cheng et L. K. Fu and the Japanese yew *T. cuspidata* Sieb et Zucc. resulted in the isolation of two rearranged 11(15→1)*abeo*taxanes and a rearranged 2(3→20)*abeo*taxane. In this communication, we describe the isolation and structure elucidation of these three new compounds.



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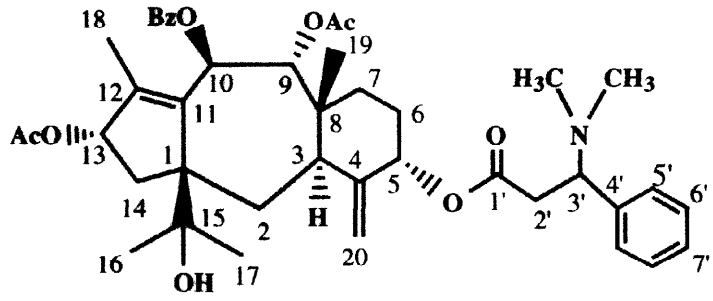

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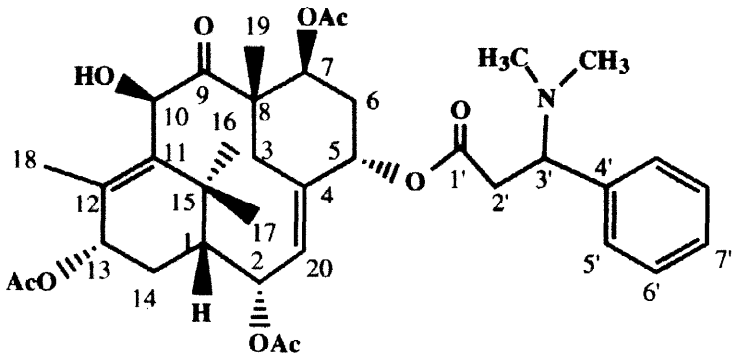

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A methanolic extract of the seeds of *Taxus yunnanensis* Cheng et L. K. Fu was processed as described in the materials and methods section to afford two novel taxane diterpenoids (**1** and **2**). Compound **1** was isolated as a colorless gum in a yield of 0.00028% on the dry seeds of *Taxus yunnanensis* Cheng et L. K. Fu. FAB-MS produced ion peak at *m/z* 437 ($[M+H]^+$). The molecular formula of compound **1**, $C_{24}H_{36}O_7$, was deduced from combined analysis of HR-FAB-MS at *m/z* 419.2433 ($[M+H-H_2O]^+$) (△ + 0.0 mmu) and ^{13}C-NMR spectrum. The IR spectrum had absorptions at 3400 and 1730 cm^{-1}, characteristic of hydroxyl and ester groups, respectively. The ^{1}H-NMR spectrum of **1**, tabulated in Table 1, exhibited the proton signals due to the four methyl groups at δ 0.74, 1.38, 1.83, and 1.15, and two acetyl groups at relatively lower field (δ 2.03 and 1.99), which was verified by the observation of ^{13}C-NMR signals at δ 171.6 and 171.1. These signals suggested that **1** had a taxane-type skeleton. The connectivities of the protons on the taxane skeleton of **1** were determined by analysis of the ^{1}H-^{1}H COSY spectrum. Interpretation of ^{1}H-, ^{13}C-NMR and HMBC spectra permitted the positional assignment of functional groups. The ^{1}H-NMR signals at δ 5.04 (1H, brs), 4.66 (1H, brs) and 2.84 (1H, brd, J = 8.5 Hz) are characteristic of an exocyclic methylene and C-3 ring junction proton in a taxa-4(20),11-diene,

respectively.[15] The one proton doublet of doublets at δ 2.00 and one-proton doublet at δ 1.33 were assigned to the C-2 methylene protons, H-2α and H-2β, respectively, based on their geminal coupling ($J2\alpha,2\beta$ = 13.7 Hz), and coupling to the H-3α broad doublet at δ 2.84 ($J2\alpha,3\alpha$ = 8.5 Hz). Similarly, H-5β (δ 4.29) was correlated with the two-proton multiplet of H-6 (δ 1.75), which also shared cross-peaks with the multiplets at δ 1.55, which was assigned to H-7. The isolated doublet of doublets at δ 5.55 and 4.47 were assigned to H-9β and H-10α, respectively. The vicinal coupling between H-9β and H-10α with the coupling constants of J = 9.9 Hz indicated their *trans*-orientation in the molecule. The spin system derived from 18-CH_3, H-13β, H-14α, and H-14β was readily interpreted by ^{1}H-^{1}H COSY spectrum of **1**. The signal of a three proton doublet at δ 1.83 was assigned to 18-CH_3 based on the long-range coupling with H-13β; the broad triplet at δ 5.47 was assigned to H-13β; a pair of doublet of doublets at δ 2.40 and 1.18 were assigned to the C-14 methylene protons, H-14β and H-14α, respectively, based on their germinal coupling and coupling to H-13β. All of the proton-bearing carbons were assigned by an analysis of the HMQC spectrum. Four oxygen-containing carbons (C-5, C-9, C-10, and C-13) were correlated with their corresponding proton signals. The signal at δ 25. 8 and δ 27.3 corresponding to C-16 and C-17 (methyl groups), respectively, showed cross-peaks with two three proton signals at δ 1.38 and δ 1.15. An analysis of the HMBC spectrum permitted an unambiguous assignment of the C-18 and C-19 signals, the ester functions, and quaternary carbons. The signal at δ 81.0 (C-9) showed a ^3J coupling with the C-19 methyl group (δ H 0.74) and at the same time, both H-3α (δ 2.84) and H-9β signals displayed cross-peaks with an up-field signal at δ 16.9 (C-19) and with the resonance at δ 41.80 (C-8). The H-9β and H-13β signals showed cross-peaks with carbonyl carbons, and these, along with their down-field positions (δ 5.55, and 5.47, respectively), strongly indicated that two acetoxy groups attached to C-9 and C-13. The H-10α signal showed cross-peaks with the resonances at δ 141.3, 141.2 and 61.9, which were assigned for C-11, C-12, and C-1, respectively. The C-11 and C-12 carbon signals showed cross-peaks with the H-14β resonance, which indicated that both C-11 and C-12 are three bonds apart from H-14β. This mean that the A ring was a cyclopentene as in an 11(15→1)*abeo*taxane structure.[16-18] The carbon signal at δ 75.8, assigned to the hydroxyl-bearing C-15, displayed a cross-peak with the C-16 and C-17 methyl resonances at δ 1.38 and 1.15. The C-1 signal (δ 61.9), apart from H-10α, also showed three-bond coupling with the H-3α and C-16, C-17 methyl signals. Since no cross-peak was observed between C-16, C-17 (methyl) signals and the C-11 olefinic carbon in the HMBC spectrum further supported the 11(15→1)*abeo*taxane skeleton for **1**.[19] The C-11 and

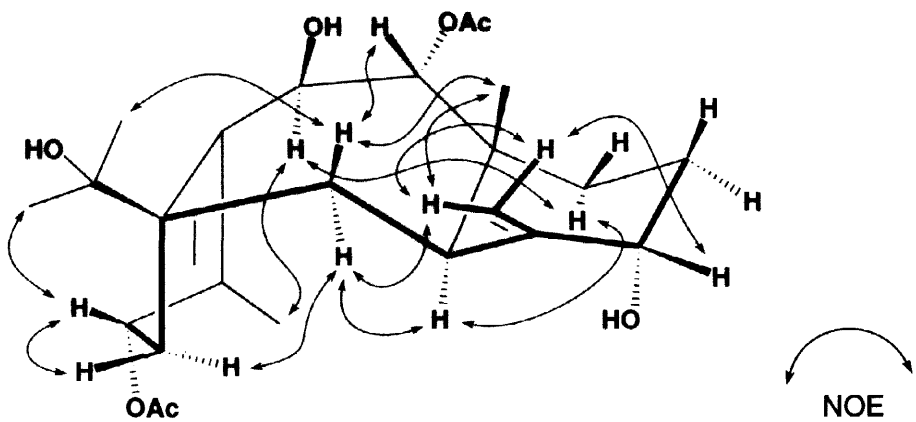

Fig. 1. Relative stereochemistry of **1**, proposed by NOESY spectrum (500 MHz).

C-12 carbon signals also showed coupling with a three-proton resonance at δ 1.83, assigned to the C-18 methyl. Since the carbon signal at δ 16.9 was assigned to the C-19 methyl, the remaining carbon signal in the methyl region at δ 11.4 must be assigned to C-18 methyl. From the above results, the structure of **1** was shown to be 9α,13α-diacetoxy-11(15→1)*abeo*taxa-4(20),11-diene-5α,10β,15-triol. The relative stereochemistry (Figure 1) of **1** was deduced from the NOESY experiment and the coupling constants.

Compound **2** was isolated as a colorless gummy substance in a yield of 0.0003 % on the dry material. EI-MS produced a protonated ion peak at *m/z* 715 ($[M]^+$). The molecular formula of compound **2**, $C_{42}H_{53}O_9N$, was deduced from combined analysis of HR-EI-MS at *m/z* 715.3721 ($[M]^+$) ($\triangle$ + 0.1 mmu) and ^{13}C-NMR spectrum. Intensive absorptions at 3550, 1735, 1720 cm^{-1} in the IR spectrum implied that **2** possesses hydroxyl and ester groups, respectively. The ^{1}H-NMR spectrum of **2**, tabulated in Table 1, exhibited the proton signals due to the four methyl groups at δ 0.74, 1.15, 1.36, and 1.99, which were the characteristic signals of the taxane skeleton. Two acetyl groups at relative lower field (δ 1.78 and 1.94), which was verified by the observation of ^{13}C-NMR signals at δ 170.2 and 170.8. These signals suggested that **2** had a taxane-type skeleton. The connectivities of the protons attached the taxane skeleton of **2** were determined by analysis of the ^{1}H-^{1}H COSY spectrum. Interpretation of ^{1}H-, ^{13}C-NMR and HMBC spectra permitted the positional assignment of functional groups. The ^{1}H-NMR signals at δ 5.12 (1H, brs), 4.74 (1H, brs) and 2.73 (1H, d, J = 5.7 Hz) are characteristic of an exocyclic methylene and C-3 ring junction proton in a taxa-4(20),11-diene, respectively.[15] Additionally, four oxygen-bearing one-proton signals appeared at lower field. Of them, the signal at δ 5.96 (1H, d, J = 10.4 Hz), which showed cross peaks with 19-CH_3, C-11, and a carbonyl carbon in the HMBC spectrum, was attributed to H-9β. The signal at δ 6.41 (1H, d, J = 10.4 Hz), which showed a cross peak with H-9β in the ^{1}H-^{1}H COSY experiment, was assigned to H-10α. Large vicinal coupling indicated a *trans*-oriented configuration of the H-9β and H-10α. The spin system derived from 18-CH_3, H-13β, H-14α, and H-14β was readily interpreted by ^{1}H-^{1}H COSY spectrum. The signal of three protons as a doublet at δ 1.99 was assigned to 18-CH_3 based on the long-range coupling with H-13β; the broad triplet signal at δ 5.50 (1H, t, J = 7.1 Hz), was assigned to H-13β; the doublet of doublets at δ 2.51 and the multiplet at δ 1.23 were atributed to the C-14 methylene protons, H-14β and H-14α, respectively, base on their geminal coupling and coupling to H-13β. The signal at δ 5.25 (1H, brs) was characteristic of H-5β in a taxa-4(20),11-diene. All of the proton-bearing carbons were assigned by an analysis of the HETCOR spectrum. Four oxygen-containing carbons (C-5, C-9, C-10, and C-13) were correlated with their corresponding proton signals. The H-10α signal showed cross-peaks with the resonances at δ 137.5, 146.1 and 63.1, which were assigned for C-11, C-12, and C-1, respectively. The C-11 and C-12 carbon signals also showed cross-peaks with the H-14β resonance, which indicated that both C-11 and C-12 are three bonds apart from H-14β. This means that the A ring was a cyclopentene as in an 11(15→1)*abeo*taxane structure.[15] The carbon signal at δ 75.9, assigned to the hydroxyl-bearing C-15, displayed a cross-peak with the C-16 and C-17 methyl resonances at δ 1.36 and 1.15. The C-1 signal (δ 63.1), apart from H-10α, also showed three-bond coupling with the H-3α and C-16, C-17 methyl signals. Since no cross-peak was observed between C-16, C-17 (methyl) signals and the C-11 olefinic carbon in the HMBC spectrum further supported the 11(15→1)*abeo*taxane skeleton for **2**. The presence of a Winterstein acid [(3'-dimethylamino-3'-phenyl)-propionyloxyl] moiety in **2** was suggested from the signals at δ 2.18 (6H, s), 2.91

Table 1. ^{1}H- and ^{13}C-NMR Spectral Data of **1** and **2** (300 MHz for ^{1}H, 125 MHz for ^{13}C, $CDCl_3$).

	1			**2**		
Position	δ ^{1}H (ppm)	*J*	δ ^{13}C (ppm)	δ ^{1}H (ppm)	*J*	δ ^{13}C (ppm)
1			61.9			63.1
2α	2.00 dd	8.5, 13.7	29.1	2.18 m		29.2
2β	1.33 d	13.7		1.40 m		
3	2.84 brd	8.5	39.4	2.73 d	5.7	40.6
4			152.3			147.0
5	4.29 brs		73.2	5.25 brs		74.9
6	1.75 m		31.0	1.40 m		29.3
7	1.55 m		27.1	1.58 m		27.2
8			41.8			41.7
9	5.55 d	9.9	81.0	5.96 d	10.4	77.5
10	4.47 d	9.9	7.6	6.41 d	10.4	70.0
11			141.3			137.5
12			141.2			146.1
13	5.47 brt	6.4	80.4	5.50 brt	7.1	79.4
14α	1.18 dd	5.8,15.4	43.8	1.23 m		44.4
14β	2.40 dd	6.9,15.4		2.51 dd	7.1, 14.0	
15			76.8			75.9
16	1.38 s		25.8	1.36 s		24.99
17	1.15 s		27.3	1.15 s		27.6
18	1.83 brs		11.4	1.99 brs		11.9
19	0.74 s		16.9	0.74 s		16.8
20a	5.04 brs		109.7	5.12 brs		112.1
20b	4.66 brs			4.74 brs		
9-OAc	2.03 s		21.3, 171.6	1.78 s		20.9, 170.2
13-OAc	1.99 s		21.2, 171.1	1.94 s		20.6, 170.8
1'						170.5
2'a				2.91 dd	7.9, 13.5	
2'b				2.65 dd	5.5, 13.5	39.7
3'				3.80 brt	7.9	67.2
4'						138.6
5'				7.30 m		129.2
6'				7.30 m		128.2
7'				7.30 m		128.2
$N(CH_3)_2$				2.18 s		42.5
1"						164.9
2"						129.2
3"				7.88 brd	8.1	129.5
4"				7.44 m		128.9
5"				7.58 t	7.5	128.4

(1H, dd, J = 13.5, 7.9 Hz), 2.65 (1H, dd, J = 13.5, 5.5 Hz), 3.80 (1H, t, J = 8.2 Hz), and 7.30 (5H, m) in the ^{1}H-NMR spectrum, and the signals at δ 170.5, 39.7, 67.2, 138.6, 129.2, 128.2, 128.2, and 42.5 in the ^{13}C-NMR spectrum, these are in good agreement with literature values.[20-22] Further support was provided by the fragment ions in the EI-MS at *m/z* 192.1022 and 134.0965 (base peaks) that analyzed for $C_{11}H_{14}O_2N$ ($\triangle$ - 0.3 mmu) and $C_9H_{12}N$ ($\triangle$ - 0.4 mmu) by HR-EI-MS, respectively, which were the characteristic fragments of Winterstein acid.[22] The location of the Winterstein acid moiety was deduced at C-5 from the HMBC spectrum (Figure 2). The benzoyloxy connected to C-10 and acetoxy groups located at C-9 and C-13, respectively, from the observations of ^{1}H-^{13}C correlations in the HMQC spectrum. The relative stereochemistry of the terpenoid skeleton of **2** was determined from chemical shifts, coupling constants and NOESY experiment. A coupling constant of J = 10.4 Hz between H-9 and H-10 indicated that the B-ring was the chair-boat conformation. The relative stereochemistry of **2** was established by the NOESY experiment and coupling constants, which was the same as its analogues.[22] Thus, the structure of **2** was determined as 9α,13α-diacetoxy-10β-benzoyloxy-5α-(3'-dimethylamino-3'-phenyl)-propionyloxy-11(15→1)*abeo*taxa-4(20),11-diene-15-ol.

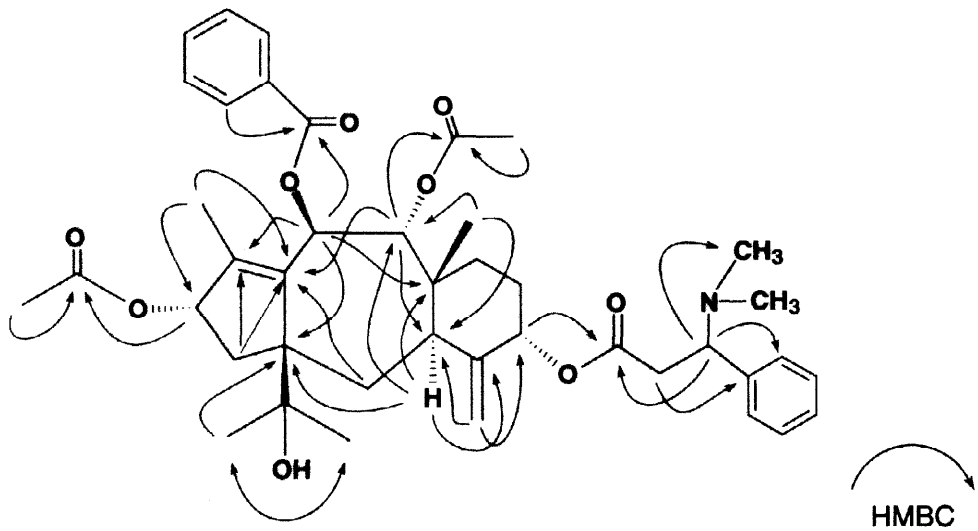

Fig. 2. Major ^{1}H-^{13}C long-range correlations of **2**, observed by HMBC spectrum (500 MHz).

Compound **3** was obtained as a colorless gummy substance from the methnolic extract of the seeds of *T. cuspidata* Sieb et. Zucc and showed the molecular ion at *m/z* 668 $[M+H]^+$ in the positive FAB-MS spectrum. HR-FAB-MS analysis revealed the molecular formula of **3** was $C_{37}H_{49}NO_{10}$ (*m/z* 668.3434 $[M+H]^+$, + 0.0). Extensive absorption at 3430, 1730, and 1680 cm^{-1} in the IR spectrum implied that **3** possessed hydroxy, ester and ketone groups, respectively. The ^{1}H-NMR spectrum (Table 2) showed the characteristic signals due to taxoid skeleton, including four methyl (δ 1.16, 1.16, 1.97, and 1.24), and three acetyl methyl (δ 1.98, 2.01, and 2.01) groups. Protons due to a a Winterstein acid [(3'-dimethylamino-3'-phenyl)-propionyloxyl] moiety appeared at δ 2.17 (6H, s), 3.08 (1H, dd, J = 8.0, 14.0 Hz), 2.85 (1H, dd, J = 7.7,m 14.0 Hz), 3.99 (1H, t, J = 7.8 Hz), and 7.29 (5H, m) in the ^{1}H-NMR spectrum, and the signals at δ 171. 9, 39.7, 67.2, 138.9, 129.0, 129.2, 127.67, and 42.5 in the ^{13}C-NMR spectrum, which are in good adreement with literature values.[20] Prominent fragment peaks at *m/z* 194 and 134 were characteristic for fission of Winterstein acid group from **3**, which were analyzed for $C_{11}H_{16}O_2N$ ($\triangle$ + 0.1 mmu) and $C_9H_{12}N$ ($\triangle$ + 0.2 mmu) by HR-FAB-MS, respectively. Detailed

analysis of the ^{1}H-^{1}H COSY spectrum revealed connectivities of C-14 to C-1, C-1 to C-20, C-5 to C-7, C-2' to C-3', and C-5' to C-7'. The spin system derived from 18-CH_3, H-13β, H-14α, and H-14β was readily interpreted. The signal of 3H as a doublet at δ 1.97 was assigned to 18-CH_3 based on its long-range coupling with H-13β; the broad doublet at δ 5.43 was assigned to H-13β; the multiplets at δ 2.73 and double of doublet δ 1.98 were assigned to the C-14 methylene protons, H-14β and H-14α, respectively, based on their geminal coupling and coupling to H-13β. The doublet of doublets at δ 1.63, which correlated with H-14β in the ^{1}H-^{1}H COSY spectrum, was assigned to H-1β. The signal at δ 5.67, which correlated with H-1β in the ^{1}H-^{1}H COSY spectrum, was attributed to H-2β. The proton H-2β coupled with the signal at δ 5.34 (1H, brd J = 9.6 Hz) instead of the signals at δ 2.8–4.0 ppm in the ^{1}H NMR spectrum characteristic of proton of H-3α in most taxoids.[1,2,15] In the ^{1}H NMR spectrum, however, a pair of singlets was lacking, corresponding to the AX system (chemical shift difference about 0.30 ppm) of the exocyclic methylene protons seen in many taxoids. Additionally, no AB quartet (at about δ 4.20 ppm with a coupling constant of about 9 Hz) corresponding to an oxetane ring, was observed.[2,14] An isolated spin system of doublets at δ 2.72 and 1.92 with the coupling constant J = 15.4 Hz occurred insteadly.

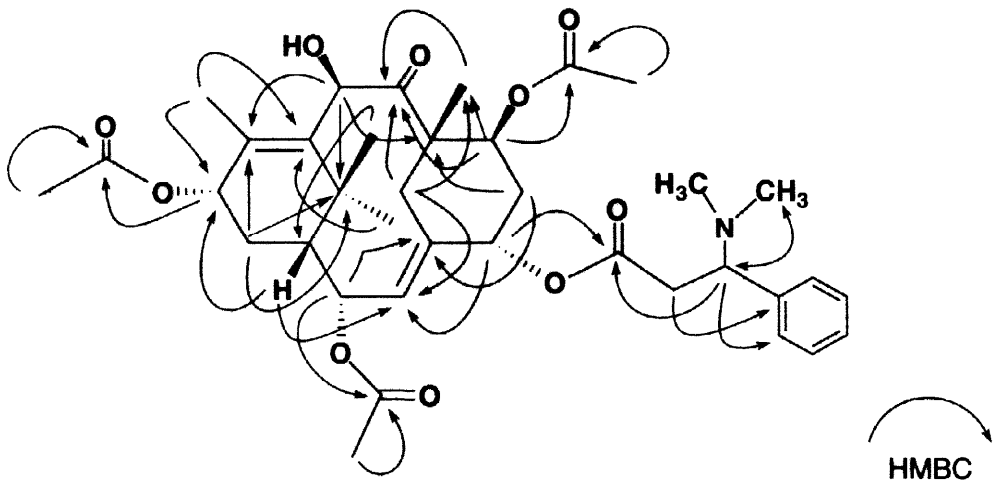

Fig. 3. Key ^{1}H-^{13}C long-range correlations (HMBC, 500 MHz) of **3**.

In the ^{13}C-NMR spectrum, besides the signals due to Winterstein acid group, other four peaks in the alkene region (δ 132.6, 136.7, 133.0, and 124. 7) revealed the existence of two double bonds, of which the one at δ 124.7 carried a proton, while others were quaternary, as shown in the HMQC spectrum. The signals at δ 132.6 and 136.7 were assigned to C-11 and C-12, respectively, based on the HMBC spectrum. Because the signal at δ 124.7 ppm correlated only with the single-proton broad doublet at δ 5.34 ppm in the HMQC spectrum, the C-4/C-20 double bond might be endocyclic instead of exocyclic, which is common in many natural taxoids. Keeping the above observations in view, the skeleton of compound **3** was elucidated as consisting of a 6/10/6 membered ring with a C-4/C-20 endocyclic double bond, belonging to a 2(3→20)*abeo*taxane derivative, as in taxine A.[23,24] The ^{1}H and ^{13}C data of compound **3** were fully categorized on the basis of ^{1}H-^{1}H COSY, HMBC (Figure 3) and HMQC spectra as shown in Figure 1. Based on the coupling constants and NOESY spectra, the protons at 2, 5, 7, 10 and 13 were assigned to β, β, α, α and β, respectively, having the same configurations as found in taxine A, and in most natural taxoids. The relative stereochemistry of compound **3** was

Table 2. ^{1}H- and ^{13}C-NMR spectral data of **3** in $CDCl_3$

Position	^{1}H	*J*	^{1}H-^{1}H COSY	^{13}C
1	1.63 dd	2.2, 8.5	H-2β, 14β	47.9
2	5.67 dd	2.2, 9.9	H-1β, 20	71.7
3a	2.72 brd	15.4	H-3b, 5β	
3b	1.92 brd	15.4	H-3a, 20	36.0
4				133.0
5	5.50 brd	5.8	H-3a, 6α	69.7
6α	2.20 m		H-5β, 7α	33.2
6β	1.38 dd	3.0, 15.4	H-6α, 7α	
7	5.00 dd	3.0, 12.7	H-6α, 6β	71.2
8				53.8
9				213.8
10	5.46 d	2.8	10-OH	77.4
11				132.6
12				136.7
13	5.43 brd	11.3	H-14α, 14β, 18-CH_3	70.4
14α	1.98 dd	3.6, 15.5	H-13 β, 14β	28.0
14β	2.73 ddd	8.5, 11.3, 15.5	H-1β, 14α, 13β	
15				38.4
16	1.16 s			32.7
17	1.16 s			25.4
18	1.97 brs		H-13	17.3
19	1.24 s			22.2
20	5.34 brd	9.9	H-2β, 3b	124.7
2-OAc	2.01 s			21.7, 170.7
7-OAc	1.98 s			22.1, 170.4
13-OAc	2.01 s			21.4, 171.3
10-OH	4.17 d	2.8	H-10β	
1'				171.9
2'a	3.08 dd	7.8, 14.0	2'b, 3'	39.7
2'b	2.85 dd	7.8, 14.0	2'a, 3'	
3'	3.99 t	7.8	2'a, 2'b	67.2
4'				138.4
5'	7.29 m			129.0
6'	7.29 m			129.2
7'	7.29 m			127.7
N-CH_3	2.17 s			42.5

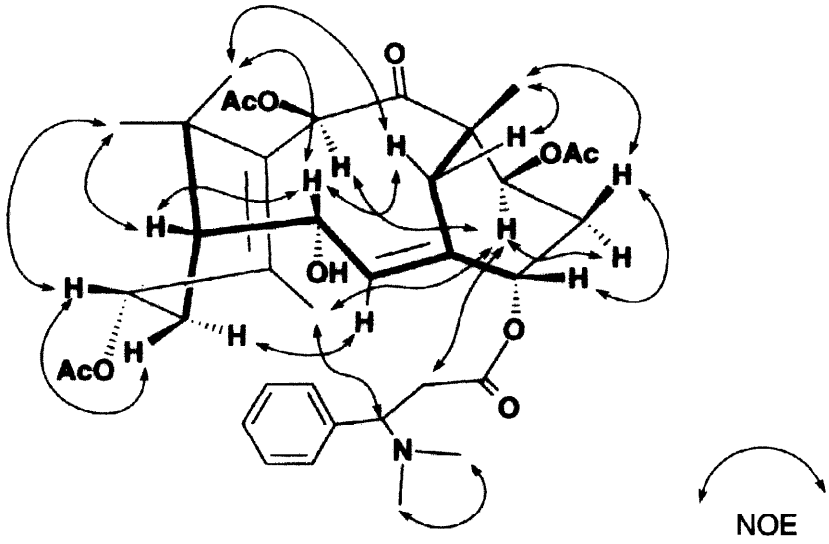

Fig. 4. Relative stereochemistry of **3**, deduced from the NOESY experiment (500 MHz).

elucidated as shown in Figure 4 by the results of the NOESY experiments. The NOESY spectrum showed NOE correlations between H-2 and H-3a, 17-CH3; H-20 and H-14α, which indicated *E*-configuration of C-4 double bond. In addition, correlations between H-13β and 16-CH_3; H-7α and 18-CH_3; H-3b and H-6β implied that both rings A and B had adopted boat conformations, which was in accordance with that of taxine A. Therefore, compound **3** was characterized unambiguously as 2α,7β,13α-triacetoxy-10β-hydroxy-5α-(3'-dimethylamino-3'-phenyl)-propionyloxy-2(3→20)*abeo*taxa-9-one.

Three known compounds isolated from the seeds of *T. cuspidata* were identified as taxezopidine J,[25] 7,2'-bisdeacetoxyaustrospicatine,[26] and taxine II[27] by the means of spectral analysis.

EXPERIMENTAL

General: Optical rotations were recorded on a Horiba SEPA-300 digital polarimeter. IR spectra were obtained on a Jasco IR–810 instrument. MS were measured on a Jeol JMS-700 spectrometer using EI and FAB modes. ^{1}H- and ^{13}C-NMR spectra were obtained with a Varian Unity Inova 500 and Varian GEMINI 2000/300 spectrometers operating at 500 and 300 MHz for ^{1}H, 125 MHz for ^{13}C nucleus, in $CDCl_3$ at 20 ℃. Open column chromatography was performed using Merck silica gel 60 (100-200 mesh). Thin layer chromatography was carried out with the precoated Merck silica gel 60 F_{254} plates. Preparative TLC were performed using the same type of plates as used for TLC but with 0.85 mm (dried for 24 hours at room temperature and activated for 4 hours at 120 ℃) thickness, the spots were detected under UV (254 nm) and/or by spraying with 10% sulfuric acid and then heating on a hot plate.

Plant material: The seeds of *T. yunnanensis* were collected in Congteng country, Yunnan Provice, in the south-west of China, in October of 1995. The botanical identification was made by Prof. J. H. Wang, School of Pharmaceutical Science, Hebei Medical University, P. R. China. The plant material was stored at 5 ℃ until work up. The seeds of *T. cuspidata* Sieb et Zucc were collected in Toyama Prefecture of Japan, in October of 1998. The botanical identification was made by one of the authors (Takashi Oritani). The voucher specimen have been deposited in our laboratory at Graduate School of Agricultural Science, Tohoku University, Japan.

Extraction and Isolation: Air dried seeds (2.2 kg) of *T. yunnanensis* Cheng et L. K. Fu were crushed and extracted with hexane three times at room temperature to remove major part of nondesired neutral component. The residue was extracted three times with methanol (MeOH), the MeOH extracts were condensed to residue (135 g) under reduced pressure. Subsequently this residue was diluted with water and was extracted five times with EtOAc (85 g). The combined EtOAc layer was further extracted with 5% HCl. After neutralization, the aqueous layer was extracted three times with EtOAc. The combined EtOAc extract, upon evaporation, yielded 8.8 g of yellowish syrup, which was subjected to coloumn chromatography (CC), eluted with hexane-ethyl acetate (2:1, 1:1, 1:2, 1:4), 12 fractions were obtained, and fraction 5 (900 mg) was further separated by preparative thin layer chromatography (TLC) repeatedly with different developing solvent ($CHCl_3$-MeOH, hexane-EtOAc, hexane-acetone), and finally compound **1** (6.3 mg) was separated. The fraction 4 (600 mg) was further separated by preparative TLC repeatedly with $CHCl_3$-MeOH, hexane-EtOAc, and hexane-acetone finally offered compound **2** (6.5 mg). Air dried and crushed seeds (0.9 kg) of *T. cuspidata* Sieb et Zucc were extracted with hexane three times at room temperature to remove most undesired neutral components. The remaining plant material was extracted twice with methanol (MeOH). The MeOH extracts were pooled, condensed and partitioned between EtOAc and water. The combined EtOAc layer, after condensed to residue (25 g) under reduced pressure, was absorbed on 30 g of silica gel and subjected to silica gel (300g) column chromatography. The coloumn was eluted with hexane-acetone (4:1, 3:1, 2:1, 1:1 and 1:2, each 2000 *ml*) into eleven fractions. Fr. 7 (1750 mg) was repeatedly separated and purified by means of preparative TLC of silica gel with hexane-acetone, hexane-EtOAc, and $CHCl_3$-MeOH as the solvent systems, which finally afforded compound **3** (3.5 mg), taxezopidine J (4 mg), 7,2'-bisdeacetoxyaustrospicatine (11 mg), and taxine II (9 mg).

9α,13α-Diacetoxy-11(15→1)abeotaxa-4(20),11-diene-5α,10β,15-triol (**1**): Gum, $[\alpha]_D^{24}$ -17°(*c* 0.01, $CHCl_3$). IR (film, $CHCl_3$) ν_{max}: 3400, 2950, 2930, 1730, 1370, 1240, 1020, 960, 920, 890, and 750 cm^{-1}; FAB-MS: *m/z* (rel. int): 437 ($[M+H]^+$) (5),419 ($[M+H-H_2O]^+$) (49), 377 ($[M+H-AcOH]^+$) (3), 359 ($[M+H-H_2O-AcOH]^+$) (40), 341 ($[M+H-H_2O-AcOH]^+$) (25), 317 ($[M+H-2AcOH]^+$) (12), 299 ($[M+H-H_2O-2AcOH]^+$) (61), 281 ($[M+H-2H_2O-2AcOH]^+$) (24), 241 (60), 185 (50), 93 (100), and 55 (74). HR-FAB-MS: 419.2433 (calcd for $C_{24}H_{35}O_6$, 419.2433). The ^1H- and ^{13}C-NMR spectral data see Table 1.

9α,13α-Diacetoxy-10β-benzoyloxy-5α-(3'-dimethylamino-3'-phenyl)-propi-onyloxy-11(15→1)abeotaxa-4(20),11-diene-15-ol (**2**). Colorless gum, $[\alpha]_D^{24}$ -13.0° ($CHCl_3$, *c* 0.01); IR ν_{max} ($CHCl_3$, film) cm^{-1} : 3550, 2950, 1735, 1710, 1650, 1600, 1450, 1370, 1240, 1110, 10230, 910, 730, and 710. EI-MS *m/z*: 715 $(M)^+$, 655 $(M-AcOH)^+$, 637 $(M-AcOH-H_2O)^+$, 597, 535, 415, 192, 134, 105, and 77. HR-EI-MS *m/z*: 715.3721 (calcd for $C_{42}H_{53}O_9N$, 715.3720). 192.1022 calcd for $C_{11}H_{14}O_2N$, 192.1025),

134.0965 (calcd for $C_9H_{12}N$, 134.0969). ^1H- and ^{13}C-NMR data: see Table 1.

2α,7β,13α-Triacetoxy-10β-hydroxy-5α-(3'-dimethylamino-3'-phenyl)-propionyloxy-2(3→20)abeotaxa-9-one (**3**). Colorless gum, $[\alpha]_D^{24}$ -31.0° ($CHCl_3$, *c* 0.01); IR ν_{max} ($CHCl_3$, film) cm^{-1} : 3430, 2970, 2930, 1730, 1680, 1450, 1360, 1230, and 750. FAB-MS *m/z*: 668 $(M+H)^+$, 608, 277, 194, 185, 134, 93, 75, 57 and 43. HR-FAB-MS *m/z*: 668.3434 (calcd for $C_{37}H_{50}O_{10}N$, 668.3434), 194.1182 (calcd for $C_{11}H_{16}O_2N$, 194.1181), 134.0972 (calcd for $C_9H_{12}N$, 134.0970). ^1H- and ^{13}C-NMR data: see Table 2.

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