THALICSESSINE, A NEW C_{20}-DITERPENOID ALKALOID FROM THALICTRUM SESSILE HAYATA

Yang-Chang Wu,*[,1] Tian-Shung Wu,+ Masatake Niwa, Sheng-Teh Lu,++
and Yoshimasa Hirata

Faculty of Pharmacy, Meijo University, Tempaku, Nagoya 468,
Japan; +Department of Applied Chemistry, Providence College of
Arts and Science, Taichung, 40211, Taiwan, R. O. C.; ++School
of Pharmacy, Kaohsiung Medical College, Kaohsiung, 80731,
Taiwan, R. O. C.

Abstract- The structure of thalicsessine, a new C_{20}-diterpenoid alkaloid isolated from *Thalictrum sessile* Hayata (Ranunculaceae), together with a known diterpenoid alkaloid spiradine A, was elucidated on the basis of spectral and chemical evidence. This is the first report on diterpenoid alkaloids obtained from the plant of the genus *Thalictrum*.

Previous studies of the plants of *Thalictrum* genus (Ranunculaceae) have shown only the presence of isoquinoline type alkaloids but not shown the presence of diterpenoid alkaloid.[2-6] We also studied on the alkaloidal constituents of *Thalictrum* plants of Taiwan. In the flora of Taiwan, the genus *Thalictrum* has five species.[7] From the roots of one of them, *Thalictrum sessile* Hayata which is a 60 cm high perennial herb, we could isolate two C_{20}-diterpenoid alkaloids. One is a new alkaloid named thalicsessine (1) and the other is a known base, spiradine A (2).[8] We now report here the structural elucidation of this new diterpenoid alkaloid thalicsessine (1) as well as spiradine A (2).
Thalicsessine (1) was obtained as colorless prisms from methanol, mp 213-216°C, $[\alpha]_D^{25}$ +113° (c=0.2, $CHCl_3$). Its molecular formula was established as $C_{22}H_{27}NO_4$ by elemental analysis and EIMS [m/z 369 (M^+)]. The spectral data showed the presence of a hydroxyethyl group attached to nitrogen [ν 3350 cm^{-1}, δ 2.85 (1H, t, J=5.12 Hz, disappeared on addition of D_2O), 3.45 (1H, ddd, J=14.16, 5.13, 3.41 Hz), 3.62 (1H, ddd, J=14.16, 8.05, 3.41 Hz), 3.78 (1H, m, changed to ddd (J=11.48, 5.13,

3.41 Hz) on addition of D_2O), 3.88 (1H, m, changed to ddd (J=11.48, 8.05, 3.41 Hz) on addition of D_2O) ppm, δ 49.7(t), 60.9(t) ppm]. Thalicsessine (1), furthermore, is suggested to be a diterpenoid alkaloid by the presence of the following groups in the molecule: two carbonyl groups [ν 1710 cm^{-1}, δ 207.6(s), 208.9(s) ppm], one lactam ketone group [ν 1630 cm^{-1}, δ 177.1(s) ppm], one exocyclic methylene group [ν 1620, 890 cm^{-1}, δ 4.85 (1H, d, J=2.40 Hz), 5.02 (1H, d, J=2.40 Hz) ppm, δ 111.1(t), 141.9(s) ppm] and one methyl group [δ 1.50 (3H, s) ppm, δ 25.5(q) ppm]. As shown in Table I, furthermore, there is a close resemblance between thalicsessine (1) and the known diketone (3)[8] derived from spiradine A (2) in terms of ^{13}C-NMR spectra. These data show that the structure of thalicsessine (1) is closely similar to that of 3 having C_{20} spiradine-type skeleton[3] except for the hydroxyethyl and lactam ketone groups. This was further supported by the following experiments. Treatment of 1 with NaOD in dioxane gave a deuterio-compound (4) [m/z 372 (M^+, $C_{22}H_{24}D_3NO_4$)], whose ^{13}C NMR spectrum showed no signals corresponding to those at δ 51.5(t) and 60.0(d) ppm in the spectrum of 1 and then treatment of 4 with $NaBH_4$ in THF followed by acetylation with acetic anhydride in pyridine gave an acetate (5) [m/z 458 (M^+, $C_{26}H_{30}D_3NO_6$)]. The ^1H NMR spectrum of 5 shows a singlet at δ 4.18 ppm as against a multiplet at δ 4.20 ppm (H-6) in the spectrum of 6 derived from 1 by the same procedure.[9] These evidence indicate that one of two carbonyl groups is located at C-6 position. Moreover, the other carbonyl group should be located at C-11 position by the following reasons. The first reason is that thalicsessine (1) was obtained together with spiradine A (2) having an amino acetal group at C-6 position and a carbonyl group at C-11 position. The second one is that a compound deuterized at C-9 or C-12 position could not be obtained in accordance with the Bredt rule. As disscused above, the structure of thalicsessine should be represented as 1. The proposed structure of thalicsessine (1) was also confirmed by the spectra of ^1H-^1H and ^{13}C-^1H correlations cosy. This is the first report on the isolation of such diterpenoid alkaloids as thalicsessine (1) and spiradine A (2) from the plant of <u>Thalictrum</u> genus.

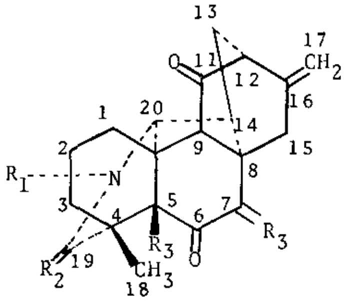
Table I. ^{13}C NMR spectra of thalicsessine (1) and the related compound (3).

Carbon	1^a	3^a	Carbon	1	3
1	39.8(t)	40.6	13	33.3(t)	33.6
2	20.6(t)	18.7	14	47.0(d)	45.6
3	34.2(t)	30.2	15	35.1(t)	35.1
4	46.5(s)	47.0	16	141.9(s)	143.5
5	60.0(d)	60.3	17	111.1(t)	110.2
6	207.6(s)^b	204.0^b	18	25.5(q)	30.7
7	51.5(t)	50.7	19	177.1(s)	61.0(t)
8	43.9(s)	43.0	20	53.9(d)	53.4
9	75.6(d)	78.2	N-CH$_2$	49.7(t)	
10	42.9(s)	38.1	CH$_2$-OH	60.9(t)	
11	208.9(s)^b	211.1^b	N-CH$_3$		43.1(q)
12	63.7(d)	65.3			

a. Chemical shift in ppm downfield from TMS in CDCl$_3$.

b. Assignments may be interchanged.

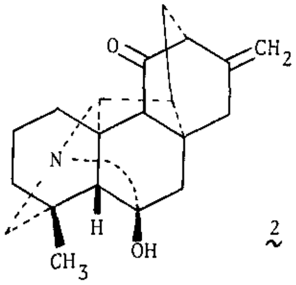
c. Spectra were taken at 25.0 MHz.



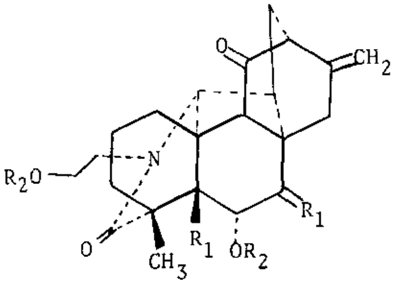
1 R$_1$=CH$_2$CH$_2$OH, R$_2$=O, R$_3$=H

3 R$_1$=CH$_3$, R$_2$=H, R$_3$=H

4 R$_1$=CH$_2$CH$_2$OH, R$_2$=O, R$_3$=D



2



5 R$_1$=D, R$_2$=COCH$_3$

6 R$_1$=H, R$_2$=COCH$_3$

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9. **6**: m/z 455 (M^+, $C_{26}H_{33}NO_6$); ν 1710, 1620, 1610 and 890 cm^{-1}; ^{1}H NMR($CDCl_3$) δ 1.33 (3H, s), 2.03 (6H, s), 3.20 (1H, ddd, J=13.92, 7.08, 5.86 Hz), 3.86 (1H, ddd, J=13.92, 5.61, 5.37 Hz), 4.20 (1H, br. m), 4.28 (2H, m), 4.75 (1H, s) and 4.95 (1H, s).

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