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A NEW SESQUITERPENE FROM THE ANDAMAN SPONGE *DYSIDEA HERBACEA*[1]

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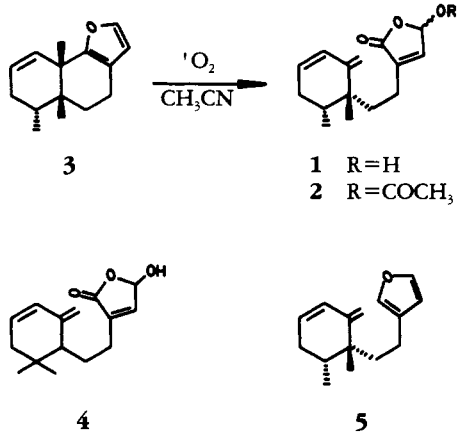
ABSTRACT.—A new sesquiterpene [**1**] has been isolated and characterized from the sponge, *Dysidea herbacea*, collected from the Andaman and Nicobar Islands, India.

During the course of our ongoing research program to isolate biologically active compounds from marine organisms, we have investigated a sponge, *Dysidea herbacea* (Keller, family Aplysillidae) collected from the Andaman and Nicobar Islands during March 1992. *Dysidea herbacea* is a widely available sponge occurring in various tropical seas. The sponge genus *Dysidea* has been shown to contain structurally interesting (1) and closely related sesquiterpenes (2–4).

A CH_2Cl_2-MeOH (1:1) extract of the sponge, *D. herbacea*, afforded the furanosesquiterpene, herbacin [**3**] (5,6) and a new sesquiterpene hydroxybutenolide [**1**]. Compound **1** was obtained as an oil, $[\alpha]^{25}D$ −22.5° (*c*=0.2, $CHCl_3$) and had ms and nmr data consistent with the elemental composition $C_{15}H_{20}O_3$. The peaks in the ir spectrum at 3380 and 1755 cm^{-1} indicated the presence of hydroxyl and γ-lactone groups. Compound **1** formed a monoacetate upon acetylation with Ac_2O/pyridine.

The ^{1}H-nmr spectrum of compound **1** showed signals for two methyls at δ 0.85 (3H, d, *J*=7.5 Hz) and 1.0 (3H, s). Furthermore, the ^{1}H-nmr spectrum of **1** indicated the presence of a terminal methylene at δ 4.85 (2H, s), conjugated with a double bond at δ 5.65 (1H, dd, *J*=10 and 4 Hz), and δ 6.05 (1H, d, *J*=10 Hz). In the low-field region of the ^{1}H-nmr spectrum occurred two broad



3 **1** R=H **2** R=$COCH_3$ **4** **5**

singlets at δ 6.1 (*CH*OH) and 6.8 (O=C-C=*CH*), which could be assigned to an α-substituted-γ-hydroxy-α,β-butenolide (2) in agreement with ir and ^{13}C-nmr (δ 172.5 s, 148.7 s, 143.5 d, and 97.3 d) data and with the formation of a monoacetate [**2**] [^{1}H nmr, δ 6.78 (2H, br s) and 2.15 (3H, s, CH_3CO)]. Compound **1** is closely related to pallescensin-3 [**4**] previously isolated from *D. pallescens* (2).

The structure and relative stereochemistry of compound **1** was further confirmed by converting **3** to **1**, which was accomplished with quantitative yield, upon reacting singlet oxygen with herbacin [**3**] in the presence of light (7). Furthermore, we have searched for possible precursors such as **5**, related to pallescensin-2 (2), but without success, suggesting that the compound **1** may be an artifact.

EXPERIMENTAL

GENERAL EXPERIMENTAL PROCEDURES.—Op-

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tical rotations were measured with a Jasco Dip 370 polarimeter. ^{1}H-nmr (200 MHz) and ^{13}C-nmr (50 MHz) spectra were recorded on a Varian Gemini 200 MHz spectrometer, using TMS as internal standard. Chemical shifts were reported in δ (ppm) values and coupling constants (*J*) in Hz. Uv and ir were recorded on a Shimadzu spectrophotometer. Mass spectra were recorded on a Finnigan MAT 1020.

COLLECTION, EXTRACTION, AND ISOLATION.—The sponge *D. herbacea* was hand-collected, by scooping it out from the intertidal rocks at Chidiatapu, Andaman and Nicobar Islands, India, during March 1992. A voucher specimen (IIC-058) is on deposit at the National Institute of Oceanography Museum, Goa, India. A freshly collected specimen (1.5 kg, wet wt) was extracted (3×) with CH_2Cl_2-MeOH (1:1) (2 liters) at room temperature. The combined extract was filtered and solvent was removed under reduced pressure. The crude extract (10.5 g) was subjected to gel-filtration chromatography (Sephadex LH-20) using CH_2Cl_2-MeOH (1:1) as eluent. Column chromatography on Si gel using hexane/EtOAc gradients yielded herbacin [**3**] (2.5 g) in hexane and compound **1** in the hexane-EtOAc (85:15) fraction. Compound **1** (45 mg) was obtained as an oil. *Anal.* found C 72.51%, H 8.23%; required for $C_{15}H_{20}O_3$, C 72.55%, H 8.11%. Uv λ max (MeOH) (ε) 224 (20000) and 230 (18000) nm; ir ν max (neat) 3380, 2950, 1755, 1655, 1450, 1080, 1010, and 940 cm^{-1}; ^{1}H nmr ($CDCl_3$) δ 6.8 (1H, br s), 6.1 (1H, br s), 6.05 (1H, d, *J*=10 Hz), 5.65 (1H, dd, *J*=10 and 4 Hz), 4.85 (2H, s), 2.1–2.5 (3H, m), 1.5–2.0 (4H, m), 1.05 (3H, s) and 0.85 (3H, d, *J*=7.5 Hz); ^{13}C nmr ($CDCl_3$) δ 172.5 (s), 148.7 (s), 143.5 (d), 138.5 (s), 129.5 (d), 126.4 (d), 111.6 (t), 97.3 (d), 47.5 (s), 37.5 (t), 34.6 (d), 31.3 (t), 21.8 (q), 19.7 (t) and 15.7 (q); eims *m/z* 248 (M^+, 6), 230 (6), 215 (10), 121 (80), 107 (100) and 91 (75).

ACETYLATION OF **1**.—A solution of **1** (10 mg) in Ac_2O/pyridine (0.5 ml) was allowed to stand at 0° for two h. The crude product was chromatographed on Si gel to give the monoacetate **2** (10 mg). Ir ν max (neat) 2935, 1780, 1740, 1460, 1210, 1080, 1010, and 980 cm^{-1}; ^{1}H nmr ($CDCl_3$) δ 6.8 (2H, d, *J*=1.5 Hz), 6.05 (1H, d, *J*=10 Hz), 5.65 (1H, dd, *J*=10 and 4 Hz), 4.9 (2H, s), 2.2–2.5 (3H, m), 2.15 (3H, s), 1.6–2.0 (4H, m), 1.05 (3H, s) and 0.9 (3H, d, *J*=7.5 Hz); eims *m/z* 230 (M^+−AcOH, 8), 120 (6), 107 (80), 91 (50).

CONVERSION OF **3** TO **1**.—Herbacin [**3**] [0.23 mmoles (50 mg)] was dissolved in 50 ml of CH_3CN containing Rose Bengal (1 mg) as sensitizer. The solution was exposed to a 500 W tungsten lamp, while bubbling oxygen into the reaction mixture for three h at room temperature. The crude reaction mixture was chromatographed over Si gel to give the hydroxy-butenolide [**1**] (50 mg). The optical rotation, ^{1}H-nmr, and mass spectrum of the synthetic compound were found to be identical to that of isolated **1**.

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