THREE NEW COUMARINS FROM LEAVES OF MURRAYA PANICULATA

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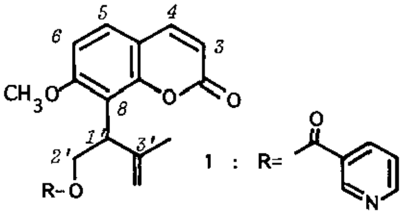
Abstract —— Three new coumarins named isomurralonginol nicotinate (1), panial (3), and cis-osthenon (4) were isolated from the leaves of Murraya paniculata collected in Iriomote Island, Okinawa.

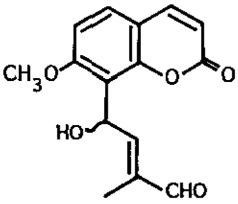
Our phytochemical studies of the constituents of the plants of genus Murraya have resulted in the isolation of many kind of coumarins and carbazole alkaloids.[1,2] In this paper we wish to describe the isolation and structure elucidation of three new coumarins, isomurralonginol nicotinate (1), panial (3), and cis-osthenon (4), from the leaves of Murraya paniculata (L.) Jack collected in Iriomote Island, Okinawa.

Isomurralonginol nicotinate (1), pale yellow oil, $[\alpha]_D$ +31.8° ($CHCl_3$), $C_{21}H_{19}NO_5$, showed typical uv data for a 7-oxygenated coumarin (see Experimental).[3] The appearance of ^{1}H-nmr signals of two pairs of AB-type doublets [δ 7.63 and 6.25 (each 1H, J = 9.4 Hz), and δ 7.37 and 6.86 (each 1H, J = 8.7 Hz)], and a 3H-singlet [δ 3.88 (OCH_3)] suggested the presence of a 7-methoxy-8-substituted coumarin nucleus in this molecule.[3] Further, the ^{1}H-nmr signal pattern (Table 1) of this coumarin, except for the proton signals due to the ester group showed a close resemblance to that of isomurralonginol acetate (2) isolated from the leaves of M. exotica,[2] thus indicating the same partial structure for this compound as that of 2.

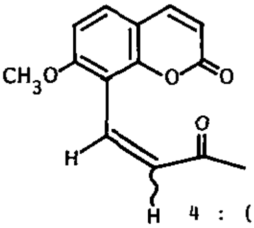


1 : R=

2 : R= Ac



3



4 : (Z)
5 : (E)

The ^{1}H-nmr signals at δ 9.01 (1H, br s), 8.72 (1H, d, J = 4.7 Hz), 8.18 (1H, d, J = 7.7 Hz), and 7.33 (1H, dd, J = 4.7 and 7.7 Hz), and a prominent mass fragment at m/z 242 (100 %) corresponding to [M^+ - C_5H_4NCOOH] revealed the presence of a nicotinate group. On the basis of these spectral data, the structure (1) was proposed for isomurralonginol nicotinate, except for the absolute stereochemistry. This is the first occurrence of a coumarin as a nicotinate in natural sources.

Table 1 ^{1}H-nmr (270 MHz, in $CDCl_3$) data of 1 compaired with those of Isomurralonginol Acetate (2).

		1	2
	3-H	6.25 (d, J = 9.4 Hz)	6.25 (d, J = 9.4 Hz)
Coumarin skeleton	4-H	7.63 (d, J = 9.4 Hz)	7.63 (d, J = 9.4 Hz)
	5-H	7.37 (d, J = 8.7 Hz)	7.36 (d, J = 8.7 Hz)
	6-H	6.86 (d, J = 8.7 Hz)	6.85 (d, J = 8.7 Hz)
	7-OMe	3.88 (3H, s)	3.88 (3H, s)
C_8-Side chain	(=C)-Me	1.74 (s)	1.70 (s)
	C=CH_2	4.97 (s)	4.92 (s)
		4.90 (s)	4.91 (s)
	1'-H	4.66 (t, J = 7.5 Hz)	4.48 (t, J = 7.5 Hz)
	2'-H	5.09 (dd, J = 7.5, 11 Hz)	4.83 (dd, J = 7.5, 11 Hz)
	2'-H	4.90 (dd, J = 7.5, 11 Hz)	4.59 (dd, J = 7.5, 11 Hz)
Ester group	OAc		1.96 (3H, s)
	Pyridine ring	9.01 (br s)	
		8.72 (d, J = 4.7 Hz)	
		8.18 (d, J = 7.7 Hz)	
		7.33 (dd, J = 4.7, 7.7 Hz)	

Panial (3) was obtained as a colorless oil; $[\alpha]_D$ -6.8° ($CHCl_3$); $C_{15}H_{14}O_5$. The 7-methoxy-8-substituted coumarin skeleton in this compound was also demonstrated by the typical uv bands (see Experimental), and two pairs of AB-type doublets [δ 7.65 (4-H) and 6.30 (3-H) (each 1H, d, J = 9.4 Hz) and δ 7.44 (5-H) and 6.91 (6-H)(each 1H, d, J = 8.7 Hz)] and a 3H-singlet at δ 4.01 (7-OMe) in the ^{1}H-nmr ($CDCl_3$) spectrum.[3] Two singlets at δ 9.45 (1H) and 1.85 (3H) were assignable to protons of an aldehyde and an allyl methyl group, respectively. A triplet at δ 6.35 (1H, J = 8 Hz) was found to couple with signals at δ 3.50 (1H, br m) and δ 6.92 (1H, d, J = 8 Hz) due to a hydroxy and a vinyl proton, respectively. Together with these spectral data, the occurrence of mass fragments at m/z 245 and 205 corresponding to [M^+ - CHO] and [M^+ - CH=C(CH_3)-CHO], respectively, showed the structure of a side chain at C_8 as [-CH(OH)-CH=C(CH_3)-CHO]. In differential NOE experiments, irradiation of the aldehyde proton at δ 9.45 gave an 11 % enhancement of the vinyl proton signal at δ 6.92. And, on irradiation of the allyl methyl protons at δ 1.85, no NOE enhancement was observed at any proton signal. These results led us to propose the structure 3 to panial.

cis-Osthenon (4) was obtained as a colorless oil; $C_{14}H_{12}O_4$. This compound was also shown to have a 7-methoxy-8-substituted coumarin nucleus by the uv and ^{1}H-nmr spectra [δ 7.62 (4-H) and 6.24 (3-H)(each 1H, d, J = 9.4 Hz) and δ 7.41 (5-H) and 6.86 (6-H)(each 1H, d, J = 8.7 Hz)]. Remaining nmr signals at δ 2.25 (3H, s), 6.48 (1H, d, J = 12.4 Hz), and 6.77 (1H, d, J = 12.4 Hz) were assigned to an acetyl protons and cis-oriented α and β protons in the α,β-unsaturated carbonyl moiety, respectively. The striking similarlity of the mass fragment pattern (Table 2) between this coumarin and osthenon (5) obtained from M. exotica[2] and some Citrus plants[4] and characterized by us, suggested they possessed the same structure except for the stereochemistry of the double bond. On the basis of these spectral data, the structure of cis-osthenon was confirmed as 4.

Table 2 Mass fragments of Osthenons (4) and (5)

4	m/z 244 (M^+, 14%), 229 (45), 213 (100), 201 (40), 186 (19), 173 (17), 158 (24)
5	m/z 244 (M^+, 17%), 229 (50), 213 (100), 201 (38), 186 (18), 173 (15), 158 (19)

EXPERIMENTAL

Extraction and Isolation: The fresh leaves (1 kg) of Murraya paniculata (L.) Jack collected in Iriomote Island, Okinawa in August, 1986 was extracted with acetone at room temperature. After evaporation of the solvent in vacuo, the residue was chromatographed over silica gel and eluted successively with benzene, benzene-isopropyl ether, and benzene-acetone. The benzene eluate was further separated with repeated PTLC using the solvent systems of appropriate mixtures of isopropyl ether, acetone, hexane, benzene, and chloroform to yield panial (3) and cis-osthenon (4) in 0.001 and 0.002 % yield, respectively. Similar treatment of the benzene-isopropyl ether fraction gave isomurralonginol nicotinate (1) in 0.003 % yield, along with many kind of known coumarins.[5]

Isomurralonginol Nicotinate (1): pale yellow oil; $[\alpha]_D$ +31.8° (c = 0.145, $CHCl_3$); high ms: m/z 365.1281 (M^+, found), 365.1262 (calcd. for $C_{21}H_{19}NO_5$); ir ν_{max} ($CHCl_3$) cm^{-1}: 1720, 1600; uv λ_{max} (MeOH) nm: 218, 247, 257, 270, 321, 340 (sh.); ei-ms m/z (%): 365 (M^+, 8), 242 (100), 229 (23), 227 (28), 214 (19), 212 (19), 211

(19), 205 (30), 199 (21), 189 (19), 187 (36); ^{1}H-nmr: (see Table 1).

Panial (3): colorless oil; $[\alpha]_D$ -6.8° (c = 0.074, $CHCl_3$); high ms: m/z 274.0863 (M^+, found), 274.0840 (calcd.for $C_{15}H_{14}O_5$); ir ν_{max} ($CHCl_3$) cm^{-1}: 1730, 1690, 1610; uv λ_{max} (MeOH) nm: 216, 234 (sh.), 258, 321, 340 (sh.); ^{1}H-nmr ($CDCl_3$) δ: 9.45 (1H, s, -CHO), 7.65 (1H, d, J = 9.4 Hz, 4-H), 7.44 (1H, d, J = 8.7 Hz, 5-H), 6.92 (1H, d, J = 8 Hz, 2'-H), 6.91 (1H, d, J = 8.7 Hz, 6-H), 6.35 (1H, t, J = 8 Hz, 1'-H), 6.30 (1H, d, J = 9.4 Hz, 3-H), 4.01 (3H, s, 7-OCH_3), 3.50 (1H, br m, OH), 1.85 (3H, s, 3'-CH_3); ei-ms m/z (%): 274 (M^+, 16), 254 (14), 245 (100), 217 (15), 210 (15), 205 (27), 203 (73), 189 (33), 175 (28).

cis-Osthenon (4): colorless oil; high ms: m/z 244.0741 (M^+, found), 244.0671 (calcd. for $C_{14}H_{12}O_4$); ir ν_{max} ($CHCl_3$) cm^{-1}: 1720, 1600; uv λ_{max} (MeOH) nm: 218, 233, 248 (sh.), 306, 340 (sh.); ^{1}H-nmr ($CDCl_3$) δ: 7.62 (1H, d, J = 9.4 Hz, 4-H), 7.41 (1H, d, J = 8.7 Hz, 5-H), 6.86 (1H, d, J = 8.7 Hz, 6-H), 6.77 (1H, d, J = 12.4 Hz, 1'-H), 6.48 (1H, d, J = 12.4 Hz, 2'-H), 6.24 (1H, d, J = 9.4 Hz, 3-H), 3.90 (3H, s, 7-OCH_3), 2.25 (3H, s, 3'-CH_3); ei-ms: (see Table 2).

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4) Unpublished data.

5) Isolation and characterization of known coumarins isolated from this plant will be reported elsewhere.

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