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A CINNAMIC ACID DERIVATIVE AND A COUMARIN FROM *MURRAYA EXOTICA*

B. R. BARIK and A. B. KUNDU

Chemical Research Unit, CCRAS, Department of Chemistry, University College of Science, 92, Acharya Prafulla Chandra Road, Calcutta-700009, India

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Key Word Index—*Murraya exotica*; Rutaceae; 4,5-[2″-hydroxy-3″-methoxy]furo-*trans*-cinnamic acid; murraxonin; 7-methoxy-8-[1′-ethoxy-2′-hydroxy-3′-methyl-but-3′-enyl]coumarin; murraxocin.

Abstract—Marraxonin, a new cinnamic acid derivative and murraxocin, a new coumarin have been isolated from the leaves of *Murraya exotica*. The compounds were characterized by spectroscopic methods and, in the case of murraxonin, by chemical reactions.

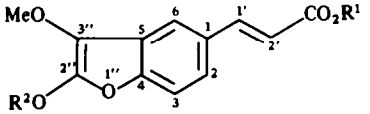
INTRODUCTION

The roots of *Murraya exotica* L. are used as a pain-killer and the leaves/bark of the plant in the treatment of diarrhoea and dysentery [1]. The plant is reported to contain several coumarins [2–8], carbazoles [9, 10] and flavonoids [11, 12]. We now report the isolation of 4,5-(2″-hydroxy-3″-methoxy) furo-*trans*-cinnamic acid (**1**) and 7-methoxy-8-[1′-ethoxy-2′-hydroxy-3′-methyl-but-3′-enyl]coumarin (**3**), designated murraxonin and murraxocin, respectively, from the leaves of this plant.

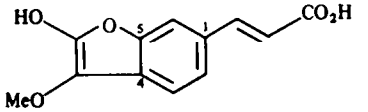
RESULTS AND DISCUSSION

Murraxonin (**1**), $C_{12}H_{10}O_5$ (M^+ 234), mp 212–215°, λ_{max}^{EtOH} 313 (log ε: 4.20), 287 (4.25), 217 (4.38) nm; $\lambda_{max}^{EtOH+NaOH}$ 344 (log ε: 3.96), 294 (4.17), 259 (4.38) and 225 (4.29) nm displayed in its IR spectrum (KBr) strong absorption bands at 3400 (hydroxyl), 1700–1670 (*br*, conjugated acid), 1630, 1615, 1582, 1515 (aromatic nucleus) and 860 (furan) cm^{-1}. On acetylation it gave a monoacetate (**1a**). $C_{14}H_{12}O_6$, mp 275–280° (d), ν_{max} 3400 (*br*, –COOH), 1755, 1210 (aromatic acetate), 1690–1675 (conjugated acid) cm^{-1}, δ2.24 (3H, *s*). Both compounds **1** and **1a** gave a positive test with $NaHCO_3$ clearly indicating the presence of a carboxylic acid group in their molecules. In agreement with this observation, methylation of **1** with ethereal diazomethane gave a monomethyl derivative (**1b**), $C_{13}H_{12}O_5$, mp 122–123° (shrinkage at 115°), ν_{max} 1736–1728 (aromatic acid ester) cm^{-1}. That **1** was a 4,5-disubstituted *trans*-cinnamic acid was confirmed by the presence in its 200 MHz ^1H NMR spectrum (in CD_3COCD_3) of doublet pairs of *trans*-olefinic protons at δ7.63 and 6.38 (1H, *d*, J = 16 Hz, each) for H-1′ and H-2′. A doublet (J = 2 Hz) at δ7.24 for one aromatic proton at C-6 was due to *meta*-coupling with the proton at C-2 which appeared at δ7.18 (1H, *dd*, J = 9 Hz, J' = 2 Hz). H-2 was also *ortho*-coupled with H-3 (δ7.05, 1H, *d*, J = 9 Hz). The above splitting pattern of the benzenoid protons clearly established that the aromatic nucleus was substituted at positions 1, 4 and 5. The ^1H NMR spectrum of **1** also revealed the presence of an aromatic methoxyl at δ3.92 (3H, *s*) and a phenolic hydroxyl at δ3.96 (1H, sharp *s*; lost on D_2O-exchange). The methoxyl group and phenolic hydroxyl were placed at C-3″ and C-2″ of the furan ring which is fused to positions 4 and 5 of the aromatic nucleus. The assignment of the hydroxyl at C-2″ could explain the alkali-induced bathochromic shifts of **1**. All the above spectral data and chemical reactions are best accounted for in terms of the structure **1** for murraxonin. This was further substantiated from the ^1H NMR spectral data (see Experimental) of **1a** and from the cracking pattern of **1**. The structure **1**, rather than **2**, is also preferred on biogenetic grounds.

The second compound, murraxocin (**3**), was isolated as its acetate (**3a**) along with auraptenol acetate. Murraxocin acetate (**3a**), $C_{19}H_{22}O_6$, mp 138–140° (ether), showed in its IR spectrum bands at 1740, 1240 (acetate), 1730 (coumarinic carbonyl) and 1605, 1560, 1498 (aromatic nucleus) cm^{-1}. Its ^1H NMR spectrum was highly in-



1 $R^1 = R^2 = H$
1a $R^1 = H$, $R^2 = COMe$
1b $R^1 = Me$, $R^2 = H$



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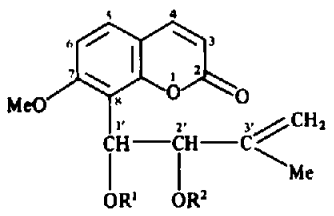
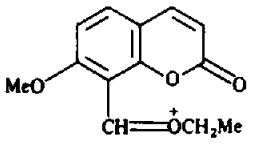


3 $R^1 = CH_2Me$, $R^2 = H$
3a $R^1 = CH_2Me$, $R^2 = COMe$
3b $R^1 = R^2 = COMe$



a, *m/z* 233

formative and revealed all the structural features of the molecule. The ^1H NMR spectral data of **3a** (see Experimental) were very similar to those reported [7] for murrangatin diacetate (**3b**) isolated from the same source except that H-1′ [–C(1′) H(OC$_2$H$_5$)–C (2′) H(OAC); δ6.06, H-2′] in the former appeared as a doublet (J = 8 Hz) at δ5.36 whereas the same proton [–C(1′)H(OAC)–C(2′)H(OAC); δ6.06, H-2′] appeared at δ6.66 (J = 9 Hz) in **3b** for obvious reasons. The location of the ethoxy group at C-1′ in **3a** and hence in **3**, was further confirmed from the presence in the mass spectrum of **3a** of an ion fragment corresponding to species, **a**. Based on the structure of murraxocin acetate (**3a**), the structure of the parent compound, murraxocin, has been formulated as **3**.

It is pertinent to mention here that the methyl ether corresponding to murraxocin was first described as a reaction product of phebalosin with methanol [13] and then isolated, as a probable artefact formed from phebalosin, from *Phebalium dentatum* [14]. It, therefore, seems probable that murraxocin is also an artefact since ethanol was used in the isolation procedure and phebalosin is a known leaf constituent of *M. exotica* [6].

EXPERIMENTAL

The plant material, procured locally, was identified by Dr S. R. Das, Survey Officer, Regional Research Institute (Ay.), Calcutta 700009. A voucher specimen of the plant material has been deposited at the Department of Chemistry, Calcutta University. Mps: uncorr; ^1H NMR (200 and 100 MHz): TMS as int. standard; MS: 70 eV; CC and TLC: silica gel (BDH, 60–120 mesh) and silica gel G (Merck) respectively. The analytical samples were dried *in vacuo* over P_2O_5 for 24 hr.

Isolation of murraxonin (**1**). Air-dried, powdered leaves of *M. exotica* (8 kg) were successively extracted with petrol and $CHCl_3$ in a Soxhlet apparatus. The marc, obtained after extraction, was further percolated with EtOH at room temp. After removal of the solvent, the crude alcoholic extract was successively fractionated with petrol, Et_2O and CH_2Cl_2. The concd extract, on repeated CC over silica gel, afforded a crude material (fraction 59–80) when the column was eluted with C_6H_6–EtOAc (19:1 and 9:1). Rechromatography of this material over silica gel with C_6H_6–EtOAc (3:1) gave murraxonin (**1**) which was crystallized from C_6H_6–Me_2CO (9:1) as light yellow crystals, yield: 0.00013%; $C_{12}H_{10}O_5$ (M^+ 234); mp 212–215°; *m/z* 234 $[M]^+$, 220, 219, 205, 150, 149 (100%), 121.

Acetylation of murraxonin. A mixture of murraxonin (**1**, 5 mg), C_5H_5N (0.2 ml) and Ac_2O (0.5 ml) was heated on water bath for 40 min. Usual work-up afforded crystals of murraxonin acetate (**1a**, yield: 4 mg) (Found: C 60.95, H, 4.24; $C_{14}H_{12}O_6$ requires: C, 60.86, H, 4.34); ^1H NMR (100 MHz, $CDCl_3$): δ2.24 (3H, *s*, –OCOMe), 3.80 (3H, *s*, –OMe), 6.24 (1H, *d*, J = 16 Hz, H-2′), 6.92 (1H, *d*, J = 8 Hz, H-3), 7.20 (1H, *d*, J' = 2 Hz, H-6), 7.36 (1H, *dd*, J = 8 Hz, J' = 2 Hz, H-2), 7.64 (1H, *d*, J = 16 Hz, H-1′).

Methylation of murraxonin. Murraxonin (**1**, 4 mg) in Et_2O was treated with ethereal CH_2N_2 at room temp. and the mixture was allowed to stand overnight. After evapn of the solvent, the crude residue was crystallized from Et_2O to afford murraxonin methyl ester (**1b**), mp 122–123° (shrinkage at 115°) (Found: C, 63.02, H, 4.71; $C_{13}H_{12}O_5$ requires C, 62.90, H, 4.83).

Isolation of murraxocin acetate. The mother liquor from the recrystallization of murraxonin (**1**) was acetylated with Ac_2O–C_5H_5N in the usual way and the crude acetate mixture was chromatographed over silica gel. Elution of the column with C_6H_6 gave auraptenol acetate (identified by comparison with an authentic sample [7]). Further elution with the same solvent yielded a solid which crystallized from Et_2O to afford murraxocin acetate (**3a**, yield: 0.00012%) (Found: C, 65.98, H, 6.22; $C_{19}H_{22}O_6$ requires C, 65.89, H, 6.35); mp 138–140°; ^1H NMR (100 MHz, $CDCl_3$): δ1.16 (3H, *t*, J = 6 Hz, –OCH_2–Me), 1.52 (3H, *s*, –Me), 2.08 (3H, *s*, –OCOMe), 3.48 (2H, *m*, –OCH_2Me), 3.92 (3H, *s*, –OMe), 4.72 (2H, *m*, $=CH_2$), 5.36 (1H, *d*, J = 8 Hz, H-1′), 6.06 (1H, *d*, J = 8 Hz, H-2′), 6.24 (1H, *d*, J = 8 Hz, H-3), 6.84 (1H, *d*, J = 8 Hz, H-6), 7.38 (1H, *d*, J = 8 Hz, H-5), 7.58 (1H, *d*, J = 8 Hz, H-4).

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