MASS SPECTROSCOPY OF PICROTOXANOLIDES OF CORIARIA, CORIAMYRTIN

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RESUMEN

Se presenta evidencia para la caracterización e identificación de Coriamirtina, una lactona sesquiterpénica de carácter tóxico presente en material colombiano de *Coriaria microphylla Poir.*, mediante el análisis de espectroscopía de masas, una discusión de los patrones de fragmentación de la molécula y analogías con tutina.

SUMMARY

Evidence for the identification and characterization of coriamyrtin, a toxic sesquiterpene lactone ocurring in Colombian material of *Coriaria microphylla* Poir., is provided by means of mass spectral data, discussions of the fragmentation patterns of the molecule and analogies with the related compound, tutin.

Palabras Claves: *Coriaria microphylla,* Coriariaceae, Lactonas sesquiterpénicas, Coriamirtina, Espectroscopía de masas.

Key Word Index: *Coriaria Microphylla,* Coriariaceae, Sesquiterpene lactones, coriamyrtin, mass spectroscopy.

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INTRODUCTION

The analeptic sesquiterpene lactone coriamyrtin (I), has been isolated from *Coriaria japonica* A. Gray. (Kariyone, 1930), *C. myrtifolia* L. (Easterfield, 1901), from Asia and *C. ruscifolia* L. from Chile (Reyes, 1980). Jaimes de Pino (1972), isolated a bitter principle made up of white needdles (m.p. 228.7°C), from Colombian material of *C. thymifolia* Humb. & Bompl. ex Willd., which, according to IR spectral analysis, appears to be coriamyrtin and which resulted toxic to mice and dogs.

The genus, however, has recieved relatively little attention from the botanical and chemical viewpoints, to the extent that there is a confusion over the valid names of the species represented in the American continent, their phylogenetic relationships to relatives from other parts of the world and the identity of the chemical compounds sinthesized by them. This has resulted in a poor understanding of its importance as a possible source of medicinally useful compounds and of its economic potential. Therefore, a perusal of the chemistry and occurrence of picrotoxanolides of Colombian *Coriaria* spp., based on spectral analitical parameters for identification, is long due. Aguirre-Gálviz (1987), has given Protonic Nuclear Magnetic Resonance evidence for coriamyrtin isolated from Colombian materials of the species growing in the Andes, while this paper provides further evidence for spectral analysis of the molecule by the study of mass spectroscopy and fragmentation patterns.

Methods of isolation, purification, chromatography and IR spectroscopy have been described elsewhere (Aguirre-Galviz, 1987). Mass spectral measurements were carried out in a VG Micromass ZAB-1F apparatus, fitted with a solid probe (70 ev) and source temperature of 0-200°C. The spectra were first taken with low resolution and, after preliminary examination, were recorded for accurate mass measurements at a resolving power of 12.000 (ie: 296, 237, 260 m/e), after which the normalized ion abundances were calculated with reference to the base peak.

RESULTS AND DISCUSSION

Coriamyrtin (I), colourless prisms (m.p. 228, 5°C), Rf = 0.20 (chloroform - methanol), 0.15 (chloroform).

$\mathrm{IR}_{\text{máx}}^{\text{Nujol}}$ cm^{-1} : 3.690-3.200 (3.520) (OH), 1.770 (lactone), 1.650 (C=C), 1.160 (epoxide). MS(probe) 70 ev, m/e (rel. int.) 278.28

$[M]^+$ (2.5) ($C_{15}H_{18}O_5$), 279$[M+1]^+$ (0.1), 263 $[M\text{-methyl}]^+$ (6.0), 237 $[263\text{-isopropenyl}]^+$ (8.4), 222 $[237\text{-methyl}]^+$ (16.8) 219 $[237\text{-}H_2O]^+$ (18.0), 207.9 $[\text{Metast.}]^+$,204 $[M\text{-}H_2O]^+$ (8.1), 202,04 $[\text{Metast}]^+$, 193 $[222\text{-CHO}]^+$ (13.0), 192 (9.0), 140(20.3), 121(23.7), 41 $[M\text{-}237]^+$ (100.0).

The normalized ion abundances in the mass spectrum of coriamyrtin appear in Table 1 and its partial mass spectrum can be seen in Fig. 1.

TABLE 1

Normalized ion Abundances in the Mass Spectrum of coriamyrtin from samples of *Coriaria microphylla* Poir at 210°C

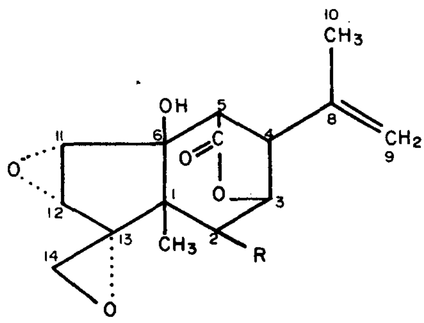
m/e	Abundance (%) (**)	m/e	Abundance (%)
41	100 (BP)	207	m*
121	23.7	219	18.0
140	20.3	222	16.77
192	9.0	237	8.47
193	13.0	263	6.0
202	m*	278	2.5 (M)
204	8.13	279	0.1 (M+1)

(*) Metastable peak.
(**) Ion intensities less than 1% of the base peak (BP), have been omitted, except for the M+1 peak.

A molecular weight of 278 was obtained for coriamyrtin, as confirmed by the molecular ion and M+1 peaks at 278 and 279 m/e respectively. This is in agreement with the formula $C_{15}H_{18}O_5$, previously assigned to the compound, and with the IR and NMR spectral evidence.

As a matter of fact, NMR data shows that the molecule possesses 18 hydrogen atoms and the presence of a hydroxyl group at position C-6, while IR spectroscopy corroborates the presence of only one hydroxyl group in the molecule (Aguirre-Gálviz, 1987).

As can be seen in Table 1 and Figures 1 and 2, the most abundant ion (base peak) of coriamyrtin, occurs at m/e 41, accounting for the isopropenyl part of the molecule and is also supported by NMR and IR spectral data.



R = H (I)
R = OH (II)

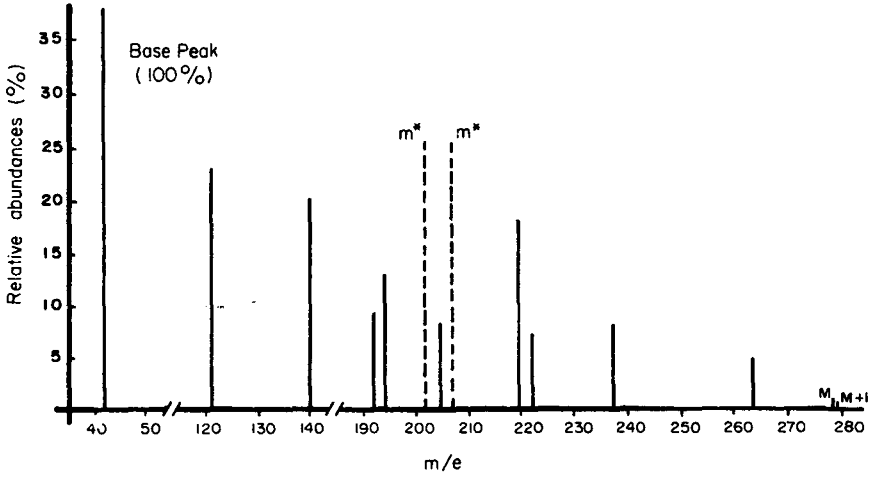


Fig. 1 : Partial Mass Spectrum of coriamyrtin.

As in the case of tutin (II), the fragment at m/e 41 shows that, once ejected, the isopropyl moiety is not further fragmented because the more reactive hydroxyl groups in the cyclic part of the molecule make it more readily ionized (Hodges & White, 1964). The ejection of the M-41 ion (m/e 237) supports the fragmentation of the isopropenyl part of compound, and occurs in an abundance of 8.47%; the presence of a fairly large metastable peak at m/e 202, 04 confirms the transformation $278^{(+)} \longrightarrow 237^{(+)}$. This transformation indirectly supports the fragmentation of the molecule into the ion at m/e 41, proving the existence of an isopropenyl branching in the structure of coriamyrtin.

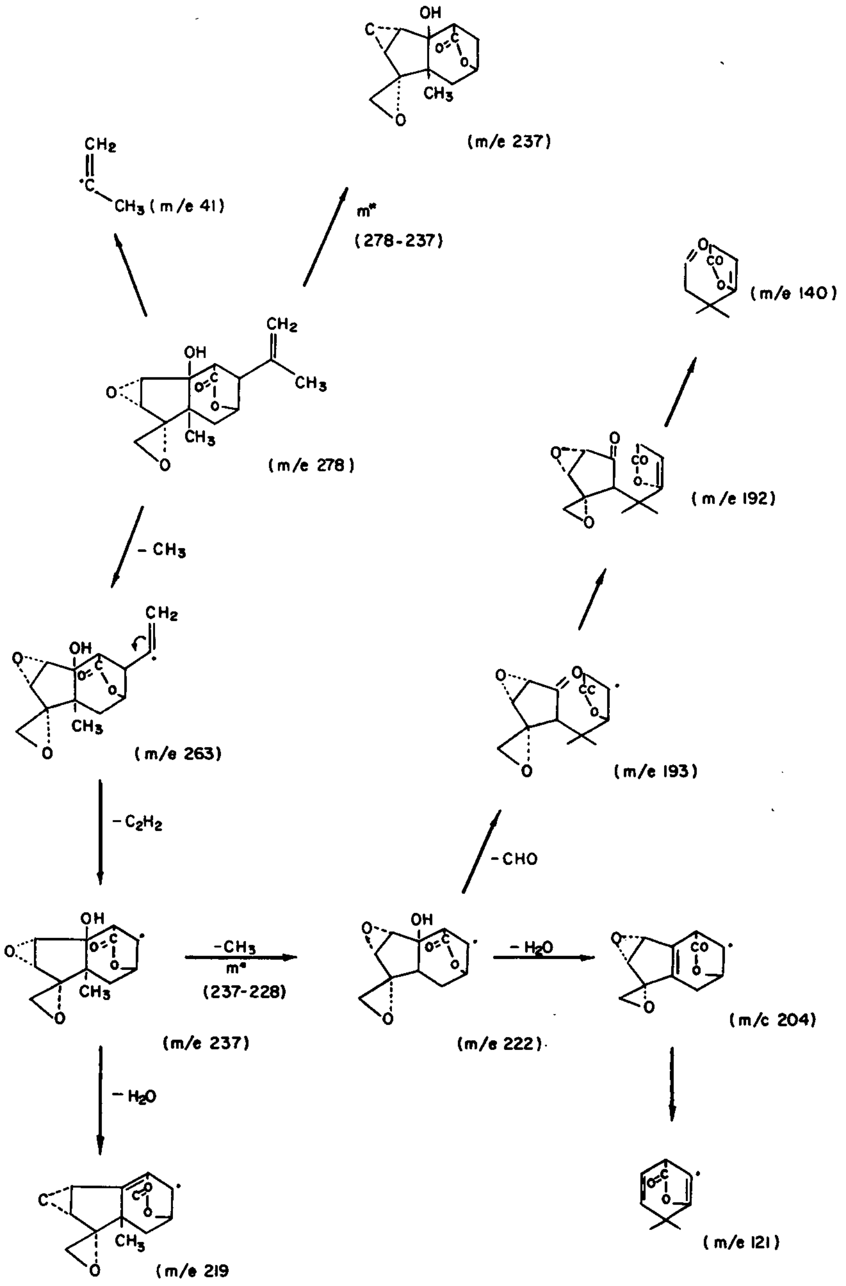


Fig. 2 : Fragmentation Patterns of coriamyrtin.

The fragment at m/e 237 suffers the loss of a methyl group resulting in the ion at m/e 222. The latter, through the loss of the elements of water and CHO, originates the fragments at m/e 204 and m/e 193, respectively.

The transformation $237^{(+)} \longrightarrow 222^{(+)}$ is supported by the appearance of the metastable ion at m/e 207.9

$$m(*) = \frac{(222)^2}{237} = 207.94936$$

The ion at m/e 237 is also subjected to the loss of the elements of water giving oxygen to the fragment at m/e 219 (Fig. 2). Internal rearrangement of the structure at m/e 193 originates the fragment at m/e 192 which, itself, undergoes fragmentation of its cyclic part to give the ion at m/e 140. The fragmentation patterns of coriamyrtin are similar to those of tutin (II), as far as the common external isopropenyl groups of their molecules is concerned, but the response of the central moieties to ionization differs markedly in the two compounds when a comparison between the mass spectra of tutin, carried out by Hodges and White (1964), and the evidence provided by the spectra of coriamyrtin obtained here, is made.

Both compounds exhibit a base peak of 41 but, in tutin, there are two hydroxyl groups located in the central cyclohexane ring one of which, centered at position C-2, drives its ionization patterns in a very different way to those of coriamryrtin. Although the number of hydrogen atoms is the same for both metabolites, tutin has a molecular weight of 294 and coriamyrtin 278, as shown by the molecular and M+1 peaks. Thus, the evidence obtained by Mass Spectroscopy indicates that the latter compound has a molecular weight of 278 and possesses an isopropenyl group in its molecule. These data, together with IR and H^+NMR evidence, strongly indicate the existence of only one hidroxyl substituent, a lactone group, an unconjugated carbon-to-carbon double bond, two epoxide systems and two methyl groups (one angular to the cyclic ring), in the compound isolated from *C. microphylla* and that such coumpound is coriamyrtin. Tutin, being 2-hydroxy-coriamyrtin, shares most of the spectral characteristics of coriamyrtin except for the molecular weight and the presence of an additional hydroxyl group attached to the central ring of the molecule.

ACKNOWLEDGEMENTS

MS measurements were made through kind collaboration of Dr. D. Carter, Mass Spectroscopy Unit of the School of Pharmacy (University of London). Dr. M. Finney (St. Bartholomew's Hospital, Mass Spectroscopy Unit), provided wise and invaluable criticisms of the analysis of mass spectral data and fragmentation patterns.

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