

DIHYDRORUGOSINONE, A PSEUDOBENZYLISOQUINOLINE
ALKALOID FROM *BERBERIS DARWINII*
AND *BERBERIS ACTINACANTHA*

EMIR VALENCIA, INGE WEISS, MAURICE SHAMMA,

Department of Chemistry, The Pennsylvania State University, University Park, Pennsylvania 16802

ALEJANDRO URZÚA,

Departamento de Química, Universidad de Santiago de Chile, Santiago 2, Chile

and VICTOR FAJARDO

Departamento de Química, Petróleo y Petroquímica, Universidad de Magallanes, Punta Arenas, Chile

The pseudobenzylisoquinolines are a small group of alkaloids incorporating a benzylisoquinoline nucleus. Ring A is usually oxygenated at C-6 and C-7, while ring C is inevitably oxygenated at C-2', 3', and 4'. It has been suggested that pseudobenzylisoquinolines could originate in vivo from the oxidative cleavage of protoberberinium salts, thus accounting for the unusual oxygenation pattern observed for ring C (1).

Known pseudobenzylisoquinolines include polycarpine (2), polyberbine (3), taxilamine (4), (-)-ledecorine (5), and rugosinone (6,7). The occurrence of pseudobenzylisoquinolines must be fairly widespread because they have been reported in members of the Annonaceae (2), Berberidaceae (3,4), Fumariaceae (5), and Ranunculaceae (6,7).

We have now observed the presence of the amorphous, new, yellow pseudobenzylisoquinoline alkaloid, dihydrorugosinone (**1**), in Chilean *Berberis darwinii* Hook. as well as in *Berberis actinacantha* Mart. ex Schult. (Berberidaceae). The 200 MHz CDCl₃ ¹H-nmr spectrum of dihydrorugosinone is summarized in formula **1**. This spec-

trum is essentially identical with that of the known synthetic dihydrorugosinone prepared by in vitro oxidation of berberine (1). Similarly, the uv spectrum of the natural product is close to that reported for the synthetic material (7).

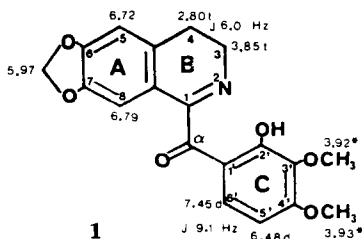
Significantly, *B. darwinii* also produces rugosinone. Because berberine is found in all *Berberis* species, it is quite possible that this quaternary alkaloid may be oxidized in vivo to dihydrorugosinone, which can then be dehydrogenated to rugosinone (1). The oxidation of dihydrorugosinone (**1**) to rugosinone has also been carried out in vitro using air and ethanolic NaOH (8).

EXPERIMENTAL

PLANT MATERIAL.—*B. actinacantha* (dried twigs, 25 kg) was collected on Cerro Lo Curro, Ciudad Santiago. *B. darwinii* (dried stems, 18 kg) was gathered near Ciudad Osorno, in south-central Chile. The plants were air-dried and powdered. They were identified botanically by Ms. Mélica Muñoz Schick of the Museo Nacional de Historia Natural in Santiago.

EXTRACTION AND ISOLATION.—The plant materials were first defatted with petroleum ether. Extraction was with cold EtOH. The dried ethanolic extracts were treated with 3N HCl. Following basification with NH₄OH, the crude alkaloids were extracted with CHCl₃. The basic compounds were then separated on silica gel columns, elution being with CHCl₃ and increasing percentages of MeOH. Final purification of the alkaloids was on silica gel TLC plates, using the systems CHCl₃-MeOH-NH₄OH (90:10:1) and C₆H₆-Me₂CO-MeOH-NH₄OH (45:45:10:1).

Dihydrorugosinone (**1**).—Each of the two plants supplied 3 mg; hrms C₁₉H₁₇NO₆, mp 220-223° (MeOH), ir ν max CHCl₃ 1620 cm⁻¹, eims *m/z*



(%) 355 (M)⁺ (42), 354 (16), 353 (53), 339 (32), 324 (34), 296 (93), 294 (82), 174 (53), 173 (42), 172 (100); ¹H-nmr (see formula **1**); uv λ max MeOH 228 sh, 299 nm (log ε 4.71, 4.50). The CDCl₃ nmr spectrum of synthetic dihydrorugosinone was inadvertently reported to show a two-proton triplet at δ 2.41 for H-4 (8). The correct chemical shift should have been δ 2.81.

Rugosinone.—From *B. darwinii* was isolated 4 mg. The spectral characteristics of this alkaloid corresponded to those reported in the literature (6,7).

ACKNOWLEDGMENTS

This work was supported by grant CHE-8210699 from the National Science Foundation.

LITERATURE CITED

1. N. Murugesan and M. Shamma, *Tetrahedron Lett.*, 4521 (1979).
2. A. Jössang, M. Leboeuf, A. Cavé, M. Damak, and C. Riche, *C.R. Acad. Sci., Ser. C*, **284**, 467 (1977).
3. S. Firdous, A.J. Freyer, M. Shamma, and A. Urzúa, *J. Am. Chem. Soc.*, (in press).
4. G. Blaskó, M. Shamma, A.A. Ansari, and Atta-ur-Rahman, *Heterocycles*, **19**, 257 (1982).
5. I.A. Israilov, M.S. Yunusov, and S. Yu. Yunusov, *Khim. Prir. Soedin.*, 537 (1978); *Chem. Nat. Comp.*, 465 (1979).
6. W.N. Wu, J.L. Beal, and R.W. Doskotch, *J. Nat. Prod.*, **43**, 143 (1980).
7. S.K. Chattopadhyay, A.B. Ray, D.J. Slatkin, and P.L. Schiff, Jr., *Phytochemistry*, **22**, 2607 (1983).
8. N. Murugesan and M. Shamma, *Heterocycles*, **14**, 585 (1980).

Received 28 June 1984