

Naphthoquinones have not previously been isolated from an *Uvaria* species. The occurrence of benzyl benzoates in this plant is further support for the already proposed biosynthetic pathway for compounds found in *Uvaria* species (7).

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LITERATURE CITED

1. S.D. Jolad, J.J. Hoffmann, K.H. Schram, and J.R. Cole, *J. Org. Chem.*, **47**, 3151 (1982).
2. C.D. Hufford, W.L. Lasswell, K. Hirotsu, and J. Clardy, *J. Org. Chem.*, **44**, 4709 (1979).
3. B. Tammami, S.J. Torrence, F.V. Fabela, R.M. Wiedhopf, and J.R. Cole, *Phytochemistry*, **16**, 2040 (1977).
4. W.L. Lasswell and C.D. Hufford, *J. Org. Chem.*, **42**, 1295 (1977).
5. Y. Ohta, N.H. Andersen, and C.B. Liu, *Tetrahedron*, **33**, 617 (1977).
6. M. Tezuka, C. Takahashi, M. Kuroyanagi, M. Satake, K. Yoshihira, and S. Natori, *Phytochemistry*, **12**, 175 (1973).
7. S.D. Jolad, J.J. Hoffmann, K.H. Schram, and J.R. Cole, *J. Org. Chem.*, **46**, 4267 (1981).

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PRESENCE OF RHOEAGENINE IN *FUMARIA PARVIFLORA*

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The alkaloids of *Fumaria parviflora* Lam. (*F. caespitosa* Loscos) (Papaveraceae) (1) have been the subject of several investigations (2-26). From these studies, the following alkaloids have been identified: adlumicine (2, 3), adlumidicine (2, 4), (+)-adlumidine (5), (+)-adlumine (5), (-)-adlumine (6), (+)-bicuculline (5-8), (\pm)-bicuculline (3, 11), bicucullinine (narceimine) (11), (-)-cheilanthifoline (3, 5), coclaurine (3), coptisine (7), (-)-corlumine (5), cryptopine (3, 6, 8), dehydrocheilanthifoline (12), dihydrofumariline (4), dihydroanguinarine (3), fumaramidine (7), fumaramine (6, 7, 14-16), fumaridine (6, 7, 14-16), fumariflorine ethyl ester (7), fumarilicine (10), (+)-fumariline (7), fumaritine (7, 10), (+)- α -hydrastine (6, 7), (+)-isoboldine (3, 7), izimirine (17), lahoramine (18), lahorine (18), 8-methoxydihydroanguinarine (13), methylhydrastinium (19), *N*-methyladlumine (3), *N*-methylhydrastine (9, 19), *N*-methylhydrastine (9), *N*-methyloxohydrastine (9, 19), narlumidine (20), norjuziphine (3), noroxyhydrastinine (7), 8-oxocoptisine (4), oxysanguinarine (3, 4), (+)-parfumidine (7, 8, 10), (+)-parfumine (7, 10, 21), (+)-parviflorine (7, 10), protopine (3, 6, 7, 8, 22, 23), the quaternary salt of protopine (24), sanguinarine (3, 25), (-)-scoulerine (3), (-)-stylopine (7), and (\pm)-stylopine (26).

We now describe the isolation and identification of rhoeagenine from the leaves and twigs of this species. This is the first rhoeadine-type alkaloid from *Fumaria*. The rhoeadine alkaloids are biogenetic derivatives of protopines, and direct evidence exists for the incorporation of labeled protopine into rhoeadine in *Papaver rhoeas* L. (27). Rhoeadines have only been found among the Papaveraceae where they are concentrated in the closely related genera *Papaver* and *Meconopsis*, with an isolated occurrence in *Bocconia* (28, 29). All the sections of *Papaver* contain rhoeadines, but the abundance and distribution of the different alkaloids varied considerably from one section to another. The sources of rhoeagenine are described in a recent review on rhoeadine alkaloids (30).

EXPERIMENTAL

PLANT MATERIALS.—The cultivated plant used in this investigation was collected from the Institute of Medicinal Plants, Budakalász, Hungary, May 1982 (182-00606115), and authenticated by Dr. G. Sag and Dr. J. Guédès, Museum National d'Histoire Naturelle, Paris, France (195/82). An herbarium specimen of the plant material is being preserved in the laboratory.

EXTRACTION, ISOLATION, AND IDENTIFICATION.—The ground, dried aerial parts (10 kg) were worked up by standard procedures (acid-base extraction) to give 110 g of total bases. Silica gel (2 kg) chromatography using C_6H_6 , followed by a gradient of $CH_2Cl_2/MeOH$, resulted in the isolation of

rhoeagenine (100 mg). It was recrystallized from EtOH, mp 236-238°, $[\alpha]^{20}_D + 135^\circ$ ($c = 1.0$, pyridine). The structure was deduced from uv, nmr, ms, ir (31-34) and confirmed by elemental analysis. The material was identified with an authentic sample by comparison with hplc and SiO₂-tlc in CH₂Cl₂-MeOH (80:20), visualized by uv and by I₂, Rf value 0.45, and in cyclohexane-diethylamine (90:10), Rf value 0.52. The color reaction with H₂SO₄ gives a red-brown-olive green color.

Full details of the isolation and identification are available on request.

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LITERATURE CITED

1. J.B.A.P. Monnet de la Marck, *Encycl. Meth. Bot.*, **2**, 567 (1782).
2. H.G. Kiryakov, "On the alkaloids of the genus *Fumaria*," Thesis Doctor of Sciences, High. Med. Institute, Plovdiv (1982).
3. M. Alimova, I.A. Israilov, M.S. Yunusov, and S.Y. Yunusov, *Khim. Prir. Soedin.*, **5**, 642 (1982).
4. M.E. Popova, V. Šimánek, L. Dolejš, D. Smysl, and V. Preininger, *Planta Med.*, **45**, 120 (1982).
5. G. Blaskó, S.F. Hussain, and M. Shamma, *J. Nat. Prod.*, **44**, 475 (1981).
6. I.A. Israilov, M.S. Yunusov, and S.Y. Yunusov, *Khim. Prir. Soedin.*, **4**, 194 (1968) and *Chem. Nat. Comp.*, **4**, 167 (1971).
7. S.F. Hussain, R.D. Minard, A.J. Freyer, and M. Shamma, *J. Nat. Prod.*, **44**, 169 (1981).
8. H.G. Kiryakov and P.P. Panov, *Folia Med.*, **16**, 101 (1974).
9. P. Forgacs, J. Provost, R. Tiberghien, J.F. Desconclois, G. Buffard, and M. Pesson, *C.R. Acad. Sc., Paris*, **276D**, 105 (1973).
10. S.F. Hussain and M. Shamma, *Tetrahedron Lett.*, **21**, 1909 (1980).
11. V.B. Pandey, B. Dasgupta, and S. Ghosal, *Indian. Inst. Chem.*, Calcutta, **46**, 120 (1974).
12. V.B. Pandey, A.B. Ray, and B. Dasgupta, *Phytochemistry*, **15**, 545 (1976).
13. V.B. Pandey, A.B. Ray, and B. Dasgupta, *Phytochemistry*, **18**, 695 (1979).
14. M. Shamma and J.L. Moniot, *J. Chem. Soc. Chem. Commun.*, 89 (1975).
15. I.A. Israilov, M.S. Yunusov, and S.Y. Yunusov, *Khim. Prir. Soedin.*, **6**, 588 (1970) and *Chem. Nat. Comp.*, **6**, 603 (1973).
16. R.G.A. Rodrigo, R.H.F. Manske, H.L. Holland, and D.B. Maclean, *Can. J. Chem.*, **54**, 471 (1975).
17. H. Guinaudeau and M. Shamma, *J. Nat. Prod.*, **46**, 934 (1983).
18. G. Blaskó, S.F. Hussain, A.J. Freyer, and M. Shamma, *Tetrahedron Lett.*, **22**, 3127 (1981).
19. P. Forgacs, J. Provost, J.F. Desconclois, A. Jehanno, and M. Pesson, *C.R. Acad. Sc., Paris*, **279 D**, 855 (1974).
20. B. Dasgupta, K.K. Seth, V.B. Pandey, and A.B. Ray, *Planta Med.*, **50**, 481 (1984).
21. I.A. Israilov, M.S. Yunusov, and S.Y. Yunusov, *Dokl. Akad. Nauk., SSSR*, **189**, 1262 (1969).
22. T.R. Govindachari, K. Nagarajan, B.R. Pai, and S. Rajappa, *J. Sci. Ind. Res.*, **17B**, 73 (1958).
23. I.A. Israilov, M.S. Yunusov, and S.Y. Yunusov, *Khim. Prir. Soedin.*, **6**, 493 (1970).
24. S. Satish and D.S. Bhakuni, *Phytochemistry*, **11**, 2888 (1972).
25. J. Susplugas, G. Privat, J. Berlan, and J.P. Sarda, *Trav. Soc. Pharm. Montpellier*, **28**, 157 (1968).
26. V.B. Pandey, K.K. Seth, and B. Dasgupta, *Pharmazie*, **37**, 453 (1982).
27. M. Shamma and J.L. Moniot, *Isoquinoline Alkaloids Research, 1972-1977*, Plenum Press, New York, 1978, pp. 337-353.
28. F. Šantavý, in: *The Alkaloids*, (Vol. 12), Ed. by R.H.F. Manske, Academic Press, New York, 1970, pp. 333-454.
29. F. Šantavý, in: *The Alkaloids*, (Vol. 17), Ed. by R.H.F. Manske and R.G.A. Rodrigo, Academic Press, New York, 1979, pp. 385-544.
30. C.T. Montgomery, B.K. Cassels and M. Shamma, *J. Nat. Prod.*, **46**, 441 (1983).
31. L. Dolejš and V. Hanuš, *Tetrahedron*, **23**, 2997 (1967).
32. J. Slavík, L. Dolejš, V. Vokáč, and V. Hanuš, *Collect. Czech. Chem. Commun.*, **30**, 2864 (1965).
33. G. Sariyar and J.D. Phillipson, *Phytochemistry*, **19**, 2189 (1980).
34. S. Pfeifer and I. Mann, *Pharmazie*, **23**, 82 (1968).

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