Phytochemistry, 1970, Vol. 9, pp. 227 to 228. Pergamon Press. Printed in England.

SHORT COMMUNICATION

FLAVONOIDS FROM *FLOURENSIA CERNUA*

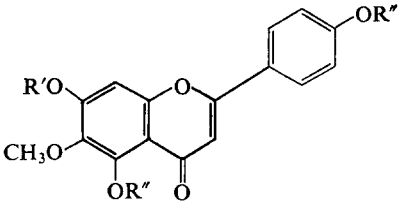
M. M. RAO,* D. G. I. KINGSTON and T. D. SPITTLER

Department of Chemistry, State University of New York at Albany, Albany, N.Y. 12203, U.S.A.

(*Received* 26 *June* 1969)

Abstract—Cirsimaritin and hispidulin have been isolated from *Flourensia cernua.*

IN CONNECTION with a study of the constituents of American poisonous plants we have examined the flavonoid constituents of *Flourensia cernua* DC (Compositae). Collection of plant material (plant heads only) was made near Sul Ross, Texas, in March 1968. Extraction of the plant material with petroleum ether followed by absolute ethanol yielded an extract from which acidic materials were removed by extraction of its ethereal solution with saturated $NaHCO_3$. The flavonoids of interest were then extracted with 10% Na_2CO_3; fractional crystallization of this fraction yielded two crystalline compounds, identified as cirsimaritin (I) and hispidulin (II).



(I) $R' = CH_3$; $R'' = H$
(II) $R' = R'' = H$
(III) $R' = R'' = CH_3$

Compound I, m.p. 262–263°, was identified as cirsimaritin by comparison of its spectroscopic properties (u.v., i.r. and NMR) and those of its diacetate with those reported[1] for cirsimaritin. In addition, methylation of I yielded a dimethyl ether identical with an authentic sample of scutellarein tetramethyl ether III[2] (u.v. and i.r.).

Compound II, m.p. 285–286°, was identified as hispidulin by direct comparison (i.r., mixed m.p.) of its triacetate with an authentic sample of hispidulin triacetate.[3] Methylation of II also gave a trimethyl ether identical with scutallarein tetramethyl ether, III. Hispidulin has recently been identified as one of the cytotoxic components of *Eupatorium* species.[4]

* Permanent address: Department of Chemistry, Kurukshetra University, Kurukshetra, Haryana, India.

[1] T. A. GEISSMAN, R. MUKHERJEE and K. Y. SIM, *Phytochem.* **6**, 1575 (1967).
[2] J. GRIPENBERG, in *The Chemistry of Flavonoid Compounds* (edited by T. A. GEISSMAN), p. 406, Macmillan, New York (1962).
[3] W. HERZ and Y. SUMI, *J. Org. Chem.* **29**, 3438 (1964).
[4] S. M. KUPCHAN, C. W. SIGEL, R. J. HEMINGWAY, J. R. KNOX and M. S. UDAYAMURTHY, *Tetrahedron* **25**, 1603 (1969).

EXPERIMENTAL

M.p.'s are uncorrected. NMR spectra were obtained with a Varian A-60A instrument (DMSO-d_6 or $CDCl_3$ as solvent with TMS as internal standard). Mass spectra were obtained on an AEI-GEC MS-902 mass spectrometer: mass measurements were carried out at a resolution of 10,000 using heptacosafluorotri-n-butylamine as a reference compound.

Extraction of Plant Material

Whole plant heads (1 kg) were extracted successively with petroleum ether, absolute ethanol, and 50% aqueous ethanol. The absolute ethanol extract was concentrated and the residue dissolved in ether, a small amount of insoluble material remaining at this stage. The ether-soluble material was extracted successively with saturated aqu. $NaHCO_3$, 10% aq. Na_2CO_3, and 0·4 N NaOH. Neutralization of the Na_2CO_3 extract and extraction with ether yielded a mixture of compounds from which I was obtained on fractional crystallization as pale-yellow flakes from methanol, m.p. 262–263° (lit. 263–265°). Concentration of the mother liquors yielded a further quantity of material which, on repeated recrystallization, gave II as pale-yellow flakes, m.p. 280–282° (lit [3] 291–292°). Materials were homogeneous on TLC (silica gel, benzene–methanol, 19:1).

4′,5-*Dihydroxy*-6,7-*Dimethoxy Flavone* (*I*)

The material had M. wt. 314·0789; $C_{17}H_{14}O_6$ requires 314·0790. Changes in the u.v. spectrum were as follows: in ethanol, λ_{max} 275 and 335 nm, log ϵ 4·23 and 4·42; in 0·002 M NaOEt, λ_{max} 278 and 398 nm; in alc. NaOAc, λ_{max} 276, 345 (inf.) and 394 nm; in EtOH–$AlCl_3$, λ_{max} 265 (inf.), 285 (inf.) 305, 369 nm. NMR signals (DMSO-d_6) at δ=7·93 and 6·93 (A_2B_2, 4H, J=9 cps, H-2′, H-3′, H-5′, and H-6′), 6·87 (s, 1H), 6·78 (s, 1H), 3·93 (s, 3H, OCH_3) and 3·77 (s, 3H, OCH_3) ppm.

4′,5-*Diacetoxy*-6,7-*Dimethoxy Flavone*

Acetylation of I with Ac_2O/pyridine gave the acetate, from methanol, m.p. 199–201° (lit. 202–203°). U.v. absorption in ethanol: λ_{max} 263 and 310 nm, log ϵ 4·28 and 4·41. NMR signals ($CDCl_3$) at δ=7·85 and 7·23 (A_2B_2, 4H, J=9 cps, H-2′, H-3′, H-5′ and H-6′), 6·88 (s, 1H), 6·53 (s, 1H), 3·97 (s, 3H, OCH_3), 3·85 (s, 3H, OCH_3), 2·47 (s, 3H, OAc), 2·32 (s, 3H, OAc) ppm.

4,5,7-*Trihydroxy*-6-*Methoxy Flavone* (*II*)

The material had M. wt. 300·0657; $C_{16}H_{12}O_6$ requires 300·0634. Changes in the u.v. spectrum were as follows: in 0·002 M NaOEt, λ_{max} 230, 277, 333 and 401 nm; in alc. NaOAc, λ_{max} 276, 300 (inf.), and 384 nm; in EtOH–$AlCl_3$, λ_{max} 265 (inf.), 285 (inf.) 304, 361 nm. NMR signals (DMSO-d_6) at δ=7·4 and 6·87 (A_2B_2, 4H, J=8 cps, H-2′, H-3′, H-5′ and H-6′), 6·68 (s, 1H), 6·51 (s, 1H), 3·75 (s, 3H, OCH_3) ppm.

4,5,7-*Triacetoxy*-6-*Methoxy Flavone*

Acetylation of II as previously described yielded the triacetate as colorless needles from ethanol, m.p. 166–167° (lit.[3] 168–170°). U.v. absorption in ethanol: λ_{max} 264 and 304 nm, log ϵ 4·31 and 4·38. NMR signals ($CDCl_3$) at δ=7·60, 7·00 (A_2B_2, 4H, J=9 cps, H-2′, H-3′, H-5′ and H-6′), 7·05 (s, 1H), 6·40 (s, 1H), 3·74 (s, 3H, OCH_3), 2·40 (s, 3H, OAc), 2·28 (s, 3H, OAc), 2·23 (s, 3H, OAc) ppm. I.r. absorption: ν_{max} 1775, 1640, 1455, 1370, 1350, 1165, 1075 and 913 cm^{-1}.

4′,5,6,7-*Tetramethoxy Flavone*

A suspension of I (50 mg) in dry acetone (40 ml) and K_2CO_3 (2 g) and Me_2SO_4 (2 ml) was refluxed for 6 hr. The product crystallized from methanol as colorless plates, m.p. 139–141°. Scutallarein tetramethyl ether has been reported as melting either at 161–162°[5,6] or at 140–141°.[7] In our hands only the second form was obtained. Molecular weight: 342·1110; $C_{19}H_{18}O_6$ requires 342·1103. U.v. absorption: λ_{max} 267 and 320 nm. I.r. absorption: ν_{max} 2940, 2840, 1632, 1600, 1455, 1350, 1115 and 978 cm^{-1}. It was identical (u.v., i.r., TLC) to an authentic sample. Methylation of II yielded a compound identical in all respects, including m.p. and mixed m.p., with that obtained from I.

Acknowledgements—We thank Professors T. A. Geissman and W. Herz for authentic samples of scutallarein tetramethyl ether, and hispidulin triacetate, respectively. We also thank Dr. Barton Warnock for collection of *Flaurensia cernua*. Financial support from The Research Corporation and The Research Foundation of the State University of New York is gratefully acknowledged.

[5] N. MORITA and M. SHINIEZU, *J. Pharm. Soc. Japan* **83**, 615 (1963).
[6] K. FUKUI, T. MAKSUMOTO and T. KINOSHITA, *Bull. Chem. Soc. Japan* **37**, 662 (1964).
[7] F. WESSELEY and G. H. MOSER, *Monatsh.* **56**, 97 (1930).