

synthetic specimens⁴ (TLC, UV, IR, MS, and m.p.). The finding supports the presence of 3-methylsulfonylpropylglucosinolate in the seeds, in keeping with the botanical affinity of *Syrenia* to cruciferous genera such as *Cheiranthus*, *Erysimum* and *Malcolmia*, typical sources of the same glucosinolate.^{2,3} (iii) Least lipophilic: identified as (*R*)-3-methylsulfinylpropyl isothiocyanate through its conversion into (—)-1-(3-methylsulfinylpropyl)-3-phenylthiourea,⁵ of established (*R*)-configuration,⁶ and critical comparison (TLC, UV, IR, MS, m.p. and $[\alpha]_D$). Most likely, the isothiocyanate derives from (*R*)-3-methylsulfinylpropylglucosinolate, first isolated from seeds of *Iberis amara* L.,⁷ but subsequently encountered in several other species of the same and other genera.^{2,3}

Acknowledgement—The authors are grateful to Mr. J. P. Hjerting and the Botanic Garden of the University of Copenhagen for the seed material.

⁴ A. KJÆR, F. MARCUS and J. CONTI, *Acta Chem. Scand.* 7, 1370 (1953).

⁵ A. KJÆR and R. GMELIN, *Acta Chem. Scand.* 10, 1100 (1956).

⁶ K. K. CHEUNG, A. KJÆR and G. A. SIM, *Chem. Commun.* 100 (1965).

⁷ O.-E. SCHULTZ and R. GMELIN, *Arch. Pharm.* 287/59, 404 (1954).

Key Word Index—*Syrenia cana*; Cruciferae; glucosinolates; 3-methylsulfonylpropylglucosinolate; allylglucosinolate; 3-methylthiopyrrolglucosinolate.

Phytochemistry, 1972, Vol. 11, pp. 1503 to 1504. Pergamon Press. Printed in England.

COMPOSITAE

FLAVONOIDS AND PHENOLIC ACIDS FROM *CIRSIIUM LANCEOLATUM*

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(Received 26 October 1971)

Several studies of the flavonoid chemistry of the relatively large genus *Cirsium* Mill. have appeared.¹ This report concerns the identification of the flavonoids and phenolic acids of mature flowering specimens of *Cirsium lanceolatum* L. (Hill.) (*Carduus lanceolatus* L.).² The flavonoids identified were kaempferol-3-*O*-glucoside, quercetin-3-*O*-glucoside, quercetin-3-*O*-galactoside, apigenin-7-*O*-diglucoside, and genkwanin-4'-*O*-glucoside. The identified phenolic acids were *p*-coumaric, caffeic, ferulic, *p*-hydroxybenzoic, protocatechuic, and vanillic acids.

EXPERIMENTAL

The plant material was collected in Jackson County, N.C., U.S.A. Herbarium specimens were deposited in the herbarium of Western Carolina University. For flavonoid and phenolic acid analyses the fresh leaves were thoroughly extracted with 80% EtOH, the extract concentrated under vacuum, diluted with hot H₂O, and filtered through celite. The aqueous solution was exhaustively extracted with EtOAc. The EtOAc

¹ J. W. WALLACE and B. A. BOHM, *Phytochem.* 10, 452 (1971).

² A. E. RADFORD, H. E. AHLES and C. R. BELL, *Manual of the Vascular Flora of the Carolinas*. Univ. of N.C. Press, Chapel Hill (1968).

was removed under vacuum and the residue taken up in MeOH. The flavonoids were purified using paper chromatography (TBA and 15% HOAc) and identified according to Mabry *et al.*³ The sugar moieties of the flavonoids were chromatographically identified on Avicel (TG-101) plates in EtOAc-HOAc-H₂O (9:2:2), *iso*-PrOH-HOAc-H₂O (60:1:39), *n*-BuOH-EtOH-H₂O (40:11:19)⁴ and EtOAc-pyridine-H₂O (12:4:5)⁵ and by paper chromatography using EtOAc-pyridine-H₂O (12:5:4).⁶ The sugars were detected with a periodate positive benzidine hydrochloride reagent or a *p*-anisidine hydrochloride reagent.⁶ The phenolic acids were identified according to Wallace.⁷ A more detailed account of the above can be found in McGowan.⁸

Acknowledgements—We gratefully acknowledge Dr. J. Dan Pittillo for his help in collecting and identifying the plant material and to Drs. E. W. Valyocsik and G. F. Morris for making some of our glassware.

³ T. J. MABRY, K. R. MARKHAM and M. B. THOMAS, *The Systematic Identification of Flavonoids*, Springer-Verlag, New York (1970).

⁴ S. HOLLMAN, in *Non-glycolytic Pathways of Metabolism of Glucose* (edited by S. HOLLMAN), Academic Press, New York (1964).

⁵ J. B. PRIDHAM, *Analyt. Chem.* **28**, 1967 (1956).

⁶ G. HOWARD, Ph.D. Dissertation, The University of Texas at Austin (1970).

⁷ J. W. WALLACE, *Am. J. Bot.* **59** (in press) (1972).

⁸ S. G. MCGOWAN, M.A. Thesis, Western Carolina University (1971).

Key Word Index—*Cirsium lanceolatum*; Compositae; flavonol glycosides; apigenin 7-diglucoside; genkwanin 4'-glucoside; phenolic acids.

Phytochemistry, 1972, Vol 11, pp. 1504 to 1505. Pergamon Press. Printed in England.

FLAVONOL-3-GLUCOSIDES IN EIGHT *EUPATORIUM* SPECIES

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(Received 28 October 1971)

Plants and sources. Almost all the plants were collected by Dr. R. K. Godfrey to whom the authors are grateful. *Eupatorium album* L. (in clearing 16 miles west of Tallahassee, on Nov. 5, 1961; FSU herbarium No. 68 317). *E. capillifolium* (Lam.) Small. (near Tallahassee, on Oct. 2, 1961; Godfrey No. 61 490). *E. capillifolium perfoliatum* (along Florida route 361, 2 miles from the coast in Taylor County, Florida, on Oct. 14, 1961; Houk No. 370, FSU herbarium No. 67 390). *E. coelestinum* L.* (near St. Marks, Wakulla Co., on Oct. 2, 1961; FSU herbarium No. 66 988). *E. cuneifolium* Willd. (in the vicinity of Lake Seminole, north of Sneads, Florida; Godfrey No. 61 389 and 3 miles west of Ponce de Leon, Holmes Co., Florida along US 90; Lazor No. 928). *E. hyssopifolium* L. var. *calcaratum* (diploid) (in Leon County, Florida, on Aug. 28, 1968; Godfrey No. 68-119). *E. perfoliatum* L. (in vicinity of St. Marks, Wakulla Co., on Oct. 2, 1961; Godfrey No. 61 493 and at crossing of side road and Florida route 20, 7 miles east of Hosford, Florida, on Sept. 20, 1968; Lazor No. 1218). *E. 'recurvans'* Small. (a special naturally occurring hybrid of *E. recurvans* and

* Revised to *Conoclinium coelestinum* (L.) A. P. DECANDOLLE, R. M. KING and H. ROBINSON, *Phytologia* **19**, 299 (1970).