

THE FLAVONOIDS OF *STEVIA CUZCOENSIS*, *STEVIA GALEOPSISIDIFOLIA*,
STEVIA SERRATA, AND *STEVIA SORATENSIS*

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The recent ethnobotanical information (1, 2) on the medicinal use of members of the genus *Stevia* (Asteraceae, Eupatorieae) and the known biological activities of the flavonoids (3) prompted our continued investigation of this group of constituents (4-6).

We report the isolatable flavonoids from three South American species, namely *Stevia cuzcoensis* Hieron., *Stevia galeopsisidifolia* Hieron., and *Stevia soratensis* Hieron., and from *Stevia serrata* Cav. Icon. Descr., which has a range throughout North and South America. All the flavonoids reported in Table 1 have been previously isolated.

TABLE 1. Flavonoids from *Stevia*

Flavonoids (reference) ^a	<i>Stevia</i> species ^b			
	1	2	3	4
jaceidin (6)	+			
centaureidin (6)	+	+		
quercetagenin-3,4,7-trimethyl ether (6, 7)				+
quercetagenin 3,6,3',4'-tetramethyl-ether (8)			+	
alpigenin-7-O-D-glucoside (9)				+
quercetin-3-O-D-galactoside (9)	+	+	+	+
quercetin-3-O-L-rhamnoside (9)			+	
quercetin-3-O-D-galactosyl-D-galactoside (9)		+		
quercetin-3-O-D-galactosyl-D-glucose (3)	+			

^aReferences refer to authentication of compounds.

^b1=*S. cuzcoensis*, 2=*S. galeopsisidifolia*, 3=*S. serrata*, 4=*S. soratensis*.

In view of the lack of detailed taxonomic investigation of the South American *Stevia*, it was of interest that the three species investigated did not show the diversity of flavonoid structure observed in the previously investigated North American *Stevia* species (6), nor in this respect do they compare favorably with the cultivated samples of the South American *Stevia rebaudiana*, which contains six glycosides and centaureidin (4). Recently, *Stevia satuireiaefolia* (Lam.) Schultz-Bip., collected in Argentina, was found to contain cirsimaritin and eupatorin in the CHCl₃ extract of the aerial parts (12). However, from the investigations of only ten out of a possible 120 species of *Stevia* (1), no clear conclusions may be drawn as to the possible taxonomic usefulness of the component flavonoids. The greater diversity of flavonoids found in the previously investigated (6) *Stevia origonoides* HBK., *Stevia microchaeta* Sch. Bip., *Stevia monardifolia* HBK., and *Stevia nepetifolia* HBK. would support the view that the genus has spread into South America from origins to be found in the southern states of North America.

EXPERIMENTAL

PLANT MATERIALS.—*S. cuzcoensis* was collected in Peru above Cuzco in the Sacsayhuaman Hills at an altitude of 3500-3600 m (voucher specimen, Soejarto and Pando 5237); *S. galeopsisidifolia* was collected in the Urubamba valley of Peru between Piri and Habaspampa, 2800 m (voucher specimen, C. Vargar 4310); and *S. soratensis* Hieron. was collected at the Vilcanota river 3500 m (voucher specimen, Soejarto and Pando 5245). *S. serrata*, one of the most common species of the genus found in South and North America, was collected in Mexico, State of Puebla, at an altitude of 6500 feet (voucher specimen, Soejarto and Compadre 5367). Flavonoid patterns (two dimensional PC) for this plant material compared favorably with herbarium material from Venezuela, Colombia, and Guatemala (9). Voucher specimens of all species are deposited in the Field Museum of Natural History, Chicago, Illinois.

EXTRACTION AND ISOLATION OF FLAVONOIDS.—The dried leaves of *S. cuzcoensis* (12 g), *S. galeop-*

sidifolia (40 g), *S. serrata* (7 g), and *S. soratensis* (20 g) were extracted and the flavonoids isolated using standard procedures (4, 5, 10). All flavonoids were identified by standard spectral (uv, ^1H nmr, ms) and hydrolytic data as well as by authentic sample comparisons and color reaction procedures (4, 5, 7, 9, 10).

ACKNOWLEDGMENTS

Mrs. A. Rajbhandari wishes to thank the British Council for generous financial support.

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Received 19 March 1985

FLAVONOID AGLYCONES AND GLYCOSIDES FROM *TEUCRIUM GNAPHALODES*

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Teucrium species are used in Spanish folk-medicine for their diuretic, antihelminthic, and carminative properties. In addition, these species are difficult to classify, and a chemotaxonomic approach might be useful. For these reasons, we have studied the flavonoids of *Teucrium gnaphalodes* L'Hér (Labiatae), a small plant that is widespread in La Mancha, Spain. Seven aglycones and five flavone glycosides have been isolated and identified.

Previously, several *Teucrium* species were investigated for flavonoids; 5-hydroxy-6,7,3',4'-tetramethoxyflavone and eupatorin were isolated from *Teucrium pseudo-chamaepitys* (1), and diosmin was isolated from *T. gnaphalodes* (2), as the only flavonoid.

From the Et₂O extract, the flavone aglycones cirsimaritin, salvigenin, cirsilineol, cirsilinol, luteolin, apigenin, and a flavanone, naringenin, have been isolated and identified by means of standard uv (3) and ms (4, 5) techniques and chromatographic comparisons against authentic markers. This is the first time that these flavone aglycones have been reported from *Teucrium* species.

From the *n*-BuOH extract, flavone monoglycosides luteolin-7-*O*-β-D-glucoside and apigenin-7-*O*-β-D-glucoside, and flavone diglycosides luteolin-7-*O*-β-D-rutinoside, luteolin-7-*O*-β-D-neohesperidoside (veronicastroside), and luteolin-7-*O*-β-D-sambubioside [xylosyl(1→2)glucoside] have been isolated. Their structures were identified by standard uv procedures, employing the naturally occurring glycosides