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C-Glycosylflavonoids in the Leaves of Gymnosperms

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The finding of vitexin derivatives as major flavonoids in needles of *Larix laricina*,[1] *L. sibirica*,[2] *L. leptolepis*,[3] *L. decidua*,[4] *L. gmelinii*[4] and, to a lesser extent, in those of *L. occidentalis*[4] instigated a literature survey on *C*-glycosides within the gymnosperms. Surprisingly, no reports had been made at the time of Alston's review in 1968,[5] although many species had been investigated for flavonoids.[6] Apart from the *Larix* compounds, *C*-glycosides had been reported in only two other species; a vitexin-like compound from *Ephedra americana*[7] and vitexin and orientin as minor constituents in *Dioon spinulosum* leaves.[8] The question, therefore, arose whether the larch may be exceptional in this respect within the Pinaceae, or even among the Gymnospermae. Therefore, leaves of a 46 species of gymnosperms were subjected to a screening for *C*-glycoflavonoids occurring as major constituents.

Fresh material was collected from the Pinetum Blijdenstein, Hilversum and from the Cantonspark, Baarn, both in the Netherlands, in Sept. 1973. Extracts were compared directly and as acid hydrolysates; where *C*-glycosides were suspected they were isolated chromatographically and their nature was determined by R_f, UV and spectral shifts.

C-Glycosides (vitexin and a related com-

TABLE 1. *C*-GLYCOSYL-FLAVONOIDS IN GYMNOSPERMS

Family	Species	*C*-glycosyl Flavonoid*
Cycadaceae	*Ceratozamia mexicana* Brongn.	—
	Cycas taiwaniana Carruth.	V + G
	Dioon edule Lindl.	—
	D. spec.	—
	Encephalartos lehmannii Lehm.	—
	Zamia media Jacq.	—
Ginkgoaceae	*Ginkgo biloba* L.	—
Araucariaceae	*Araucaria araucana* (Molina) C. Koch.	—
	A. bidwillii Hook.	—
Cephalotaxaceae	*Cephalotaxus fortunei* Hook.	—
	C. harringtoniana (Forbes) C. Koch	—
Cupressaceae	*Juniperus communis* L.	—
	J. chinensis L.	—
	Chamaecyparis formonensis Mats.	—
	Thuja occidentalis L.	—
	Callitris robusta R. Br. ex Mirb.	—
	Tetraclinis articulata (Vahl) Mast.	—
	Cupressus sempervirens L.	—
	Heyderia decurrens C. Koch	—

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TABLE 1. *Continued*

Taxodiaceae	*Cryptomeria japonica* (L.f.) D. Don.	—
	Metasequoia glyptostroboides Hu & Cheng	—
	Sequoia sempervirens (D. Don in Lamb.) Endl.	V
	Sequoiadendron giganteum (Lindl.) Buchh.	—
	Taxodium ascendens Brongn.	—
Taxaceae	*Taxus baccata* L.	—
	T. cupidata Sieb. & Zucc.	—
	T. canadensis Marsh.	—
	Torreya californica Torr.	—
	T. grandis Fort.	—
	T. nucifera (L.) Sieb. & Zucc.	—
Pinaceae	*Abies balsamea* (L.) Mill.	—
	A. grandis (Dougl.) Lindl.	—
	Cedrus libani A. Rich. in Bory	—
	Keteleeria fortunei (A. Murr.) Carr.	—
	Larix sibirica Ledeb.	V
	L. laricina (Du Roi) K. Koch†	V
	L. leptolepis (Sieb. & Zucc.) Gord.†	V
	L. decidua Mill.†	V
	L. gmelinii (Rupr.) Kuzenevat	V
	L. occidentalis Nutt.†	V
	Picea breweriana S. Watson	—
	Pinus jeffreyi Grev. & Balf.	—
	P. sylvestris L.	—
	Pseudolarix amabilis (J. Nels) Rehd.	—
	Pseudotsuga menziesii (Mirbel) Franco	—
	Tsuga chinensis (Franch.) Britzel	—
Podocarpaceae	*Podocarpus elatus* R. Br.	V
	P. falcatus (Thunb.) R. Br. ex Mirb.	—
	Saxegothea conspicua Lindl.	V
Ephedraceae	*Ephedra altissima* Desf.	G
	E. distachya L.	G

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* V—vitexin or vitexin glycoside; G—glycoflavone related to vitexin.
† Results from previous work on Larix.

pound) were found in 7 species (including one *Larix* spec.) distributed in 5 families (Table 1). It appears that *C*-glycoflavonoids are widely, but infrequently distributed in the gymnosperms. The results suggest that there may be some genus-specific distribution but this can only be proved by investigation of many more species.