Luteolin-7-glucoside as a Characteristic Component of the
Plant Genera Juncus and Luzula (Family Juncaceae)

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Luteolin-7-glucoside has been isolated in a crystalline state from
Juncus gerardi Lois. and Luzula silvatica (Huds.) Gaud., and has been
identified in another 13 species of Juncus L. and 4 species of Luzula
DC.

The flavonoids of the Monocotyledoneae are little known, and only a few
monocotyledonous families have been investigated in any detail. Most
work has been carried out on the anthocyanins, and, to a lesser extent, the
flavones and flavonols of a restricted number of genera within the families
Liliaceae, Amaryllidaceae, Iridaceae, and Gramineae. 1

Very little work has been done on the Juncaceae, 2,3 and practically nothing
is known of the chemistry of this family. The Juncaceae comprises about
320 species in 8 genera, of which Juncus and Luzula are by far the most
important, with ca. 230 and ca. 80 species, respectively.

RESULTS AND DISCUSSION

From the ethanolic extracts of Juncus gerardi a pale yellow crystalline
substance was isolated. By means of chromatography on a polyamide column
and recrystallisation from ethanol, two pure substances were obtained; these
proved to be luteolin (5,7,3',4'-tetrahydroxyflavone) and luteolin-7-glucoside,
the latter being the major component.

By means of preparative paper chromatography, luteolin-7-glucoside was
furthermore isolated from Juncus articulatus, J. conglomeratus, J. filiformis,
and J. tenuis, and from Luzula silvatica. Free luteolin was isolated from J.
articulatus and L. silvatica. The substances were chromatographically indistin-
guishable from authentic specimens isolated from Daucus leaves, 1 when
examined in at least three different systems. The ultraviolet spectra were

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also identical, both in ethanol and after addition of AlCl₃, NaOEt, NaOAc, or NaOAc/H₃BO₃.

By comparative paper chromatography luteolin-7-glucoside was shown to be present in Juncus alpinus, J. arcticus, J. biglumis (dubious, very small sample), J. bufonius, J. bulbosus, J. effusus (Plouvier mentions the isolation of luteolin-7-glucoside from this species), J. kochii, J. trifidus, J. triglumis, Luzula multiflora, L. pilosa, L. spicata, and L. sudetica. In most cases weak spots corresponding to free luteolin were observed.

Chlorogenic acid was also shown to be present in the plants.

The flavone luteolin and its O-glycosides seem to be rather widespread among the Dicotyledoneae, and their taxonomic value is uncertain, although they seem to be particularly common in the Tubiflorae and in the Compositae.

The flavonoids of the Monocotyledoneae are still little known, however, there do appear to be regularities which may be of taxonomic value. The Liliaceae are characterised by their contents of flavonoids, while flavones with few exceptions, seem to be absent, as distinct from the Iridaceae, and particularly the Gramineae, where flavones are widespread, mostly as C-glycosyl derivatives. Thus C-glycosyl lutelins have been isolated from the leaves of several gramineous species (e.g. Hordeum vulgare L.). Monoglycosides of luteolin have also been found in the Gramineae in a few cases (e.g. Paspalum conjugatum Berg.), but in the majority of cases the only flavone found is tricin (5,7,4'-trihydroxy-3',5'-dimethoxyflavone) and glycosides thereof.

In this connection it is of interest that the occurrence of luteolin-7-glucoside seems to be a characteristic feature of the genera Juncus and Luzula, as distinct from the Liliaceae and Gramineae. Unfortunately, no representatives of the remaining six genera of the family Juncaceae were available for investigation.

EXPERIMENTAL

The plants used for this investigation were collected at the following localities:
Absko, Sweden: Juncus arcticus Willd.

Melting points are corrected and were determined on a Berl block.

Ultraviolet spectra were determined in a Beckman DB spectrophotometer.

Chromatography was performed on Whatman No. 1 paper, and, for preparative work, on Whatman No. 3MM paper. The solvent used was in most cases BAW 6:1:2 (butanol:acetic acid:water); for identification 15 % acetic acid, 22 % propanol, and Forestal (acetic acid:conc. HCl:water, 30:3:10) were also used. The substances were detected by their colours in ultraviolet light, before and after fuming with ammonia. Polyamide powder (Woelm) was used for column chromatography, using methanol as eluent. The columns were prewashed with methanol to remove soluble material.

Extraction and purification

Juncus gerardi: Powdered plant material (leaves, stems, inflorescences) was extracted with ethanol until the extracts were almost colourless. The combined extracts were concentrated in vacuo at 40°, water was added, and the solution was repeatedly extracted

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with light petroleum (60—80°). During the extractions a yellowish precipitate appeared, which proved to be a flavonoid substance. Additional quantities could be obtained when the aqueous phase was further concentrated and left for some time. When the flavonoids were chromatographed on polyamide powder, two crystalline fractions were obtained; the major fraction proved to be luteolin-7-glucoside, the minor fraction being free luteolin.

Remaining Juncus and Luzula species: Powdered and dried plant material was exhaustively extracted with ethanol. The extracts were evaporated to dryness, and lipids were removed by extraction with hot petroleum ether (60—80°). The flavonoids were dissolved in methanol and isolated by preparative paper chromatography. Crystalline luteolin-7-glucoside was isolated from L. silvatica; from J. articulatus, J. conglomeratus, J. filiformis, and J. tenus the following substance was obtained for spectroscopical identification in the five different media mentioned.

Luteolin-7-glucoside. The substance isolated from J. gerardi and L. silvatica was crystallized from ethanol and melted at 258—60°. There was no depression on mixture with an authentic specimen. Absorption spectra: λ_max (EtOH) 352, 268, 257 με; (AlCl₃) 395, 360, 275 με; (NaOEt) 402, 267 με; (NaOAc) 413, 257 με; (NaOAc/Η₂BO₃) 380, 264 με. All spectra were identical with those of an authentic specimen prepared from Daucus carota leaves.

Acid hydrolysis, to which the glucoside was remarkably resistant, yielded glucose and an aglycone, which proved to be identical with the previously isolated free luteolin; m.p. 325°. Absorption spectra: λ_max (EtOH) 352, 269, 254 με; (AlCl₃) 393, 362, 276 με; (NaOEt) 406, 279 με; (NaOAc) 392, 269 με; (NaOAc/Η₂BO₃) 378, 260 με.

After acetylation the substance had absorption bands at 300 and 258 με, which are identical with the values given for luteolin tetraacetate.

All ultraviolet spectra were in good agreement with previously published values.¹ ¹ ² ³

The sugar moiety was identified as glucose by means of paper chromatography. R_F values were 0.78 for luteolin and 0.40 for luteolin-7-glucoside (BAW).

In ultraviolet light luteolin appeared as dull ochre spots, turning bright greenish yellow when fumed with ammonia. The dull ochre spots of luteolin-7-glucoside turned bright yellow when exposed to ammonia.

From Juncus gerardi a colourless substance was isolated, which was chromatographically and spectroscopically identical with an authentic sample of chlorogenic acid. Corresponding spots were observed in chromatograms of all Juncus and Luzula species investigated. The absorption spectra were as follows: λ_max (EtOH) 328, 299, 243, 217 με; (AlCl₃) 348 με; (NaOEt) 370, 308, 260 με; (NaOAc) 328, 300 με; (NaOAc/Η₂BO₃) 348, 304, 252 με.

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REFERENCES


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