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Flavonol glycosides and seed coat structure in certain species of *Epilobium* – A correlation?[1]

K.E. Denford

Department of Botany, University of Alberta, Edmonton (Alberta, Canada T6G 2E9), 24 May 1979

Summary. In a survey of 239 populations of *Epilobium* representing 17 taxa the following flavonol glycosides were found: myricetin 3-O-arabinoside; 3-O-glucoside; 3-O-rhamnoside; quercetin 3-O-arabinoside; 3-O-glucoside; 3-O-diglucoside; 3-O-rhamnoside; kaempferol 3-O-glucoside; and 3-O-rhamnoside. A correlation appears to exist between seed coat sculpturing as determined in a previous study using SEM techniques, and the flavonoid profiles.

The genus *Epilobium* is quite cosmopolitan in distribution, with several circumboreal species[2]. In many respects it appears to be ecologically nonspecific, but at the same time exhibiting a wide range of morphological and cytological variation. This is shown to its greatest degree in western North America[3]. The present day distribution of the genus indicating a possible centre of origin in this region[4].

With this in mind a survey of 17 taxa representative of the genus in northwestern America was carried out to determine if a parallel complexity occurred with respect to leaf flavonoid glycosides.

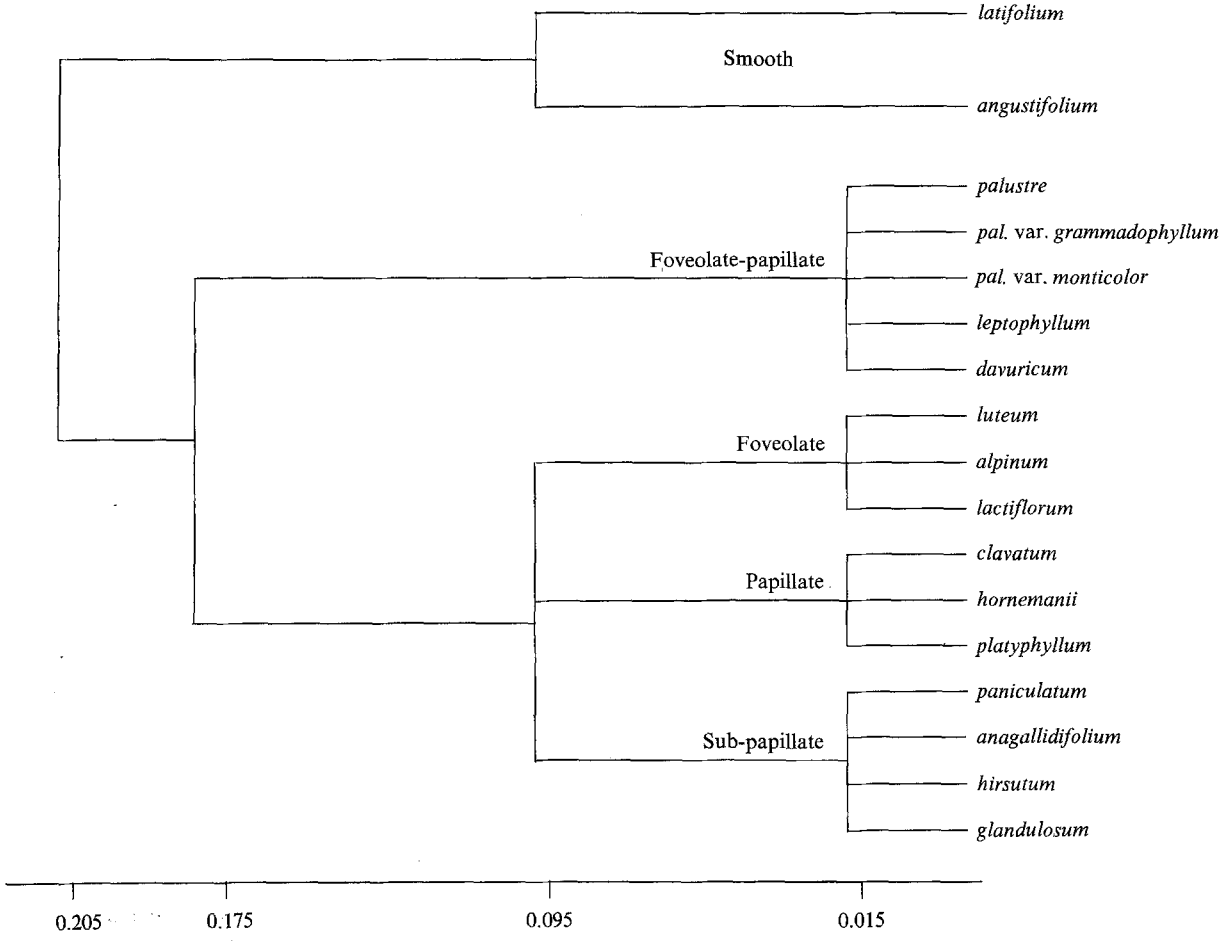
In the Onagraceae, in general, studies have been restricted mainly to the genera Oenothera[5], Circaea[6], with little being carried out on other taxa. Studies have shown that the commonly distributed flavonol glycosides[5] are present, and rarely more complicated flavonoids such as methylated derivatives and glyco-flavones[6].

In the present study the leaves of 239 populations were sampled representing 17 taxa (table) previously studied for their seed coat structures[7]. A minimum of 6 populations (10 g dry wt) were examined in any taxon. Isolation of flavonoid glycosides, hydrolytic procedures, and spectral analyses were carried out using standard methods[8], with modifications when discontinuities in distribution of compounds was found. In such situations flavonoids were exhaustively extracted using 70% methanol reduced to dryness and loaded in a minimum volume of water onto a sephadex LH 20 column. Gradient elution of glycoside mixtures was then carried out using water-methanol-acetone gradients. Flavonoids were then re-isolated and characterized using normal analytical procedures.

Flavonol glycosides in *Epilobium*

Taxon	Samples	m 3 glc	m 3 rh	m 3 arab	q 3 glc	q 3 rh	q 3 arab	q 3 diglc	k 3 glc	k 3 rh
E. latifolium	66	+	+	+	+	+	+	+	+	+
E. angustifolium	52	+	+	+	+	+	+		+	48
E. glandulosum	6	+	+	+	+	+	+			+
E. paniculatum	8	+	+	6	+	+	7			7
E. hirsutum	8	+	+	+	+	+	+			7
E. anagallidifolium	8	+	+	7	+	+	+			+
E. platyphyllum	6	+	+		+	+	+			+
E. hornemanii	12	+	+		+	+	10			+
E. clavatum	6	+	5		+	+	5			+
E. lactiflorum	6	+	+		+	+	+			
E. alpinum	17	+	+		+	+	+			
E. luteum	6	+	+		+	+	4			
E. davuricum	6	+			+	+				
E. leptophyllum	6	+			+	+				
E. palustre	14	+			+	+				
E. palustre var. *grammadophyllum*	12	+			+	+				
E. palustre var. *monticolor*	10	+			+	+				
Total	239									

m, myricetin; glc, glucose; q, quercetin; arab, arabinose; k, kaempferol; rh, rhamnose.



Epilobium single linkage analysis of flavonoid glycosides.

9 flavonol glycosides were isolated (table) based on myricetin, quercetin and kaempferol and the sugars glucose, arabinose, and rhamnose. All were simple 3-O-glycosides, however, their distributions were not ubiquitous within each taxon investigated and certain glycosides showed both inter and intra specific variation. An example of this occurs in *E. paniculatum* and *E. anagallidifolium* in which myricetin 3-O-arabinoside occurs in 75 and 85% of the populations respectively. From a phylogenetic viewpoint a significant observation in the absence of kaempferol glycosides from 8 of the taxa investigated (table). Harborne[9] had indicated that an evolutionary relationship exists which parallels reduction in 6-ring hydroxylation (myricetin → quercetin → kaempferol; primitive → advanced). Such an observation in this group may be worth pursuing from this aspect.

Previous studies by the present author using seed coat structure[7] (SEM) indicated a subdivision of the genus into papillate → foveolate → to nonpapillate groupings. A single linkage analysis of the flavonoid profiles (figure) indicates that this subdivision holds true with respect to flavonoids also. 1 group (*E. palustre,* etc.) was previously characterized as subpapillate (does not possess myricetin 3-O-rhamnoside), however, a single linkage analysis separates this group from the *E. paniculatum* group and it allies, a subgroup which was also designated subpapillate and has a chemical profile which includes myricetin 3-O-rhamnoside. On re-examining the papillation present it was concluded that 2 types of subpapillate forms exist, the *E. paniculatum* type being best described as foveolate-papillate.

In conclusion, it appears that a positive correlation exists between the leaf of flavonoid profiles of the taxa investigated and their seed coat structures[7]. However, despite the morphological and cytological variation found in these species in northwestern North America, very little variation, and a marked lack of flavonoid complexity, paradoxically typifies the genus.

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