

A Comparative Study of Flavonoids in some Members of the Papaveraceae

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Key Word Index—*Argemone*; *Fumaria*; *Glaucium*; *Hypecoum*; *Papaver*; *Roemeria*; Papaveraceae; flavonol glycosides; C-glycosides; chemosystematics.

Abstract—The leaf flavonoids of the family Papaveraceae were studied.

Introduction

Papaveraceae A. Juss., s.l., is a moderately large family in Egypt, represented by six genera and some 22 species. Most of the taxa are distributed in the Northern belt and in Sinai. *Argemone mexicana* L. was introduced from tropical America and is now completely naturalized, especially along the irrigation canals and the Nile. *Fumaria densiflora* DC. is among the common weeds of cultivated lands [1]. Tæckholm [2] included *Papaver* L., *Argemone* L., *Roemeria* Medic. and *Glaucium* Adans. in Papaveraceae, s.str., while *Fumaria* L. was treated under Fumariaceae DC. and *Hypecoum* L. under Hypecoaceae (Prantl and Kündig) Nak.

The family Papaveraceae has received attention with regards its flower anthocyanins especially the genus *Papaver* [3]. The flavonols of the family have been reported in the flowers of *Papaver* [4, 5], *Argemone* [6] and *Eschscholtzia* [7] species. Little has been reported on leaf flavonoids, with only isorhamnetin 3-*O*-arabinosyl(1→6)-glucoside being identified in the leaves of *Papaver orientale* [8].

For a better understanding of the systematic relationships among the different taxa of this group, the present study deals with leaf flavonoids of six species belonging to six genera of Papaveraceae s.l.

Results and Discussion

In the present study, six Egyptian taxa belonging to Papaveraceae were studied. The results are

outlined in Table 1. The presence of flavonol glycosides in this family is not uncommon. Quercetin glycosides have been reported in the flowers of *Eschscholtzia californica* [7] and the flowers of *Papaver somniferum* [4]. Isorhamnetin glycosides were detected in the flowers of *Argemone mexicana* [6] and the leaves of *Papaver orientale* [8]. Kaempferol has been reported to be present in *Meconopsis integrifolia* flowers [8a]. In the present study, kaempferol is present in *Fumaria parviflora* as the 3-*O*-gentiobioside, 3-*O*-rutinoside and 3-*O*-glucoside-7-*O*-galactoside. Also reported for the first time are the three C-glycosides: vicenin-2, (6,8-di-C-glucosyl)apigenin, schaftoside (6-C-glucosyl-8-C-arabinosyl)apigenin and isoschaftoside (6-C-arabinosyl-8-C-glucosyl)apigenin). These were detected in *Roemeria hybrida*. In addition, herbacetin and gossypetin 3-*O*-glucuronide-8-*O*-glucosides were reported as new glycosides in *R. hybrida* [9]. Gossypetin-7-*O*-glucoside has been detected in the petals of *Papaver nudicaule* [5].

It has been pointed out by Hallier [10] that fundamental differences exist between Papaveraceae and other families of the order Papaverales. Kjaer [11] pointed out that glucosinates are characteristic of the families Cruciferae, Capparaceae, Resedaceae and Moringaceae, but absent from the Papaveraceae. This led him to suggest that Papaveraceae may be of an entirely different ancestry.

The flavonoid chemistry shows the presence of flavonols within the Papaveraceae [3], a result confirmed by the present study. *Roemeria hybrida* seems to be highly specialized due to the fact that it contains C-glycosides, hitherto

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TABLE 1. DISTRIBUTION OF FLAVONOID GLYCOSIDES IN PAPAVERACEAE

Taxon	Kaempferol		Quercetin		Isorhamnetin	C-glycosides			Herbacetin	Gossypetin	
	3-O-Gentiobioside	3-O-Rutinoside	3-O-Glucoside-7-O-galactoside	3-O-Rutinoside	3,7-O-Diglycoside	3-O-Rutinoside	Schaftoside	Isoschaftoside	Vicenin-2	3-O-Glucuronide-8-O-glucoside	3-O-Glucuronide-8-O-glucoside
<i>Fumaria parviflora</i> Lam.	+	+	+	+	+						
<i>Hypecoum pendulum</i> L.				+							
<i>Argemone mexicana</i> L.				+	+						
<i>Glaucium corniculatum</i> (L.) J. H. Rodulph					+	+					
<i>Papaver rhoeas</i> L.				+		+					
<i>Roemeria hybrida</i> (L.) DC subsp. <i>hybrida</i>											
<i>V. hybrida</i>							+	+	t	++	+++
<i>V. tenuifolia</i> (Pamp.) Tack et Boulos							+	+	t	++	+++
subsp. <i>dodecandra</i> (Forsk.) Maire											
<i>V. dodecandra</i>							++	++	t	++	+++
<i>V. pinnatifida</i> Boiss							+	+	t	++	+++

*—Quercetin-3,7-O-diglycoside not completely identified.

t—trace; +—present; ++—strong; +++—major.

not found within the Papaveraceae. A common character between *Fumaria*, *Hypecoum*, *Argemone*, *Glaucium* and *Papaver* is the presence of quercetin, denoting a common ancestor. *Glaucium* and *Papaver* are closely allied genera which have isorhamnetin 3-O-rutinoside in common. *Fumaria* is characterized by the presence of kaempferol. It appears to be the most simple character, if only the flavonol aglycones are considered. On the other hand, its glycosylation patterns tend to indicate a more specialized character as compared with other genera. This may support the treatment of *Fumaria* in the family Fumariaceae. This treatment has been suggested by other authors [10, 11], however a more detailed study on the flavonoids of *Fumaria* and *Papaver* species is needed. A study based on the benzylisoquinoline alkaloids suggested that the Papaveraceae and Fumariaceae could be regarded as parallel groups which show different individual specializations [12].

Experimental

Plant material. Fresh material was collected from the following

localities: *Argemone mexicana* L.; Maadi Nile banks, Cairo, 12 February 1985, W. Amer. *Fumaria parviflora* Lam.; Gardens of Faculty of Agriculture, Giza, 4 February 1985, S. El-Sissi. *Glaucium corniculatum* (L.) J. H. Rodulph; Wadi Habis, West of Mersa Matrouh, Mediterranean coast, 17 March 1985, W. Amer. *Hypecoum pendulum* L.; Dir El-Rabba Gardens near St. Cathrine, Sinai, 2 April 1985, W. Amer. *Papaver rhoeas* L.; Wadi Habis, West of Mersa Matrouh, 17 March 1985, W. Amer. *Roemeria hybrida* (L.) DC. subsp. *hybrida* var. *hybrida* and var. *tenuifolia* (Pamp.) Taekholm et Boulos; Wadi Habis, West of Mersa Matrouh, 17 March 1985, W. Amer. *R. hybrida*, subsp. *dodecandra* (Forsk.) Maire, var. *dodecandra*; Dir. El-Rabba Gardens near St. Cathrine, Sinai, 1 April 1985, W. Amer. var. *Pinnatifida* Boiss.; Wadi Habis, West of Mersa Matrouh, 17 March 1985, W. Amer. Identification was carried out by Prof. Dr M. N. El-Hadidi. The Herbarium, Cairo University, and voucher specimens are deposited at the Herbarium, Cairo University (CAI).

Identification of flavonoids. Plant material (leaf and stem) was extracted with 70% EtOH, followed by evapn under red. pressure. The extracts were subjected to CC on polyamide using H₂O with increasing concns of EtOH as eluent. Fractions were further purified using elution techniques and finally CC on Sephadex LH 20. Identification was carried out according to standard methods of identification [3, 13, 14]. C-Glycosides were identified by co-chromatography with authentic samples on reversed-phase HPLC with a Lichrosorb RP 18 (10 µm) column [15]. Herbacetin and gossypetin 3-O-glucuronide-8-O-glucosides were identified through UV, FAB-MS and ¹³C NMR [9].

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