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BIOCHEMICAL PROFILE OF CROSSOSOMATACEAE

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Introduction

Crossosomataceae comprise a small angiosperm family endemic to the southwestern United States and adjacent Mexico and presently consist of two genera, *Crossosoma* Nutt. and the monotypic *Apacheria* Mason (Mason, 1975). Apart from range mapping and morphological descriptions, this family is poorly studied and its phylogenetic affiliation remains unclear. The present study was initiated in the hope that comparative phytochemistry might improve our understanding of the systematic affinities of Crossosomataceae.

Materials and Methods

Fresh, living materials were collected from *Crossosoma* plants under cultivation at the Rancho Santa Ana Botanic Garden. RSA voucher accession numbers are available in Tatsuno (1976).

Techniques of extraction, purification and identification of compounds were based of the methods of the following investigators: flavonoids (Mabry, Markham, and Thomas, 1970); anthocyanins (Harborne, 1967); ellagitannins (Bate-Smith, 1972); syringin (Shaw, 1960); saponins, cyanogenic glycosides, leucoanthocyanidins (Gibbs, 1974); iridoids (Wieffering, 1966); phenolic acids (Ibrahim and Towers, 1960); sorbitol (Shaw, 1960); paenol (Wildenhaim and Henseke, 1968) and paeoniflorin (Stahl and Cooper, 1969).

For the purpose of calculating an index of phytochemical similarity, the common occurrence of two compounds or compound classes in a pairwise comparison was given an arbitrary value of one, the common absence of characters, a less significant value of one half, and a presence/absence dissimilarity, a value of zero. These values were summed over all chemical characters and divided by the number of characters.

Results

A notable absence of flavonoid compounds (flavones/flavonols) was observed in extracts of floral, leaf, stem, and root tissues of both species of *Crossosoma.* No compounds could be detected whose chromatographic properties or fluorescence colors indicated the presence of flavonoids in either hydrolyzed or nonhydrolyzed samples.

An anthocyanin was purified from petals and sepals of both *Crossosoma* species and was identified chromatographically as cyanidin-3-glucoside.

Leucoanthocyanidins (proanthocyanidins) were found to be absent from leaf and stem tissue of both *Crossosoma* species and from *Spiraea vanhouttei* Zabel. The presence of leucoanthocyanidins was detected in leaves of *Lyonothamnus floribundus* Gray var. *asplenifolius* (Greene) Bdg. and *Physocarpus capitatus* (Pursh) Kuntze.

Gallic and ellagic acids were identified in both species of *Crossosoma* and were more prevalent in hydrolyzed than nonhydrolyzed samples. These results suggested the presence of ellagitannins and their presence was confirmed in floral tissue of both species of *Crossosoma.* Ellagitannins could not be detected in floral tissue of *Paeonia californica* Nutt. ex T. & G., *Physocarpus capitatus*, *Lyonothamnus floribundus* var. *asplenifolia* and *Spiraea cantoniensis* Lour.

Syringin was detected using a spot test and chromatographically in stem tissue of *Crossosoma californicum* Nutt., but could not be detected in *C. bigelovii* Wats. or *Paeonia californica.*

Neither paeonol nor paeoniflorin could be detected in root, stem, leaf, or bark tissues of either *Crossosoma* species.

Iridoids, saponins, sorbitol, and cyanogenic glycosides could not be detected in any tissue of either *Crossosoma* species. *Paeonia californica*, *Lyonothamnus floribundus* var. *asplenifolia*, and *Physocarpus capitatus* also lacked cyanogenic glycosides.

Discussion

Putative phylogenetic associates of Crossosomataceae include Dilleniaceae (Cronquist, 1968; Takhtajan, 1969), Paeoniaceae (Cronquist, 1968; Takhtajan, 1969), Spiraeoideae of Rosaceae (Thorne, 1976 and pers. comm.), Mimosoideae of Fabaceae (Thorne, 1976 and pers. comm.), and Connaraceae (Thorne, 1976). Compounds or compound classes were selected for examination on the basis of their demonstrated general utility in other systematic studies (flavonoids and other phenolics) or the fact that they characteristically occur in a putative affiliate (e.g., sorbitol in Rosaceae, paeoniflorin in Paeoniaceae, etc.).

A comparative phytochemical profile of Crossosomataceae and putatively related families is shown in Table 1. Crossosomataceae stand apart from all putative associates in exhibiting the apparent absence of flavones/flavonols in all tissue. This feature is the single most distinctive phytochemical feature of this family. Additionally, the presence of floral ellagitannins characterized only Crossosomataceae.

A phytochemical similarity index based on the compounds tabulated in Table 1 reveals similarity index values calculated pairwise between Crossosomataceae and putative relatives as: Dilleniaceae, 0.30; Paeoniaceae,

Table 1. Distribution of phytochemical characters among putative relatives of Crossosomataceae.[1]

	Crossosomataceae	Dilleniaceae	Paeoniaceae	Rosaceae (Spiraeoideae)	Fabaceae (Mimiosoideae)	Connaraceae
Flavone/flavonol	–	+	+	+	+	+
Paeonidin 3,5-diglucoside	–	–	+	–	–	–
Cyanidin 3-glucoside	+	–	–	+	+	–
Leucoanthocyanidins	–	+	–	+	+	–
Caffeic acid	+	–	+	+	+	–
Gallic acid	+	–	+	–	–	–
Ellagic acid	+	+	–	–	–	–
Ellagitannins	+	–	–	–	–	–
Syringin	±	–	–	–	±	–
Paeonol	–	–	+	–	–	–
Paeoniflorin	–	–	+	–	–	–
Iridoids	–	–	–	–	–	–
Saponins	–	–	–	+	+	–
Sorbitol	–	–	–	+	–	–
Cyanogenic glycosides	–	–	–	+	+	–

[1] Compound distribution data are from the present report and Bate-Smith (1961); Bate-Smith and Swain (1965); Harborne (1971); Hegnauer (1966); Gibbs (1974); Kubitzki (1968); Ulubelen (1969).

0.30; Rosaceae (Spiraeoideae), 0.26; Fabaceae (Mimosoideae), 0.37; and Connaraceae, 0.30.

These values indicate a marginally greater phytochemical similarity between Crossosomataceae and the Mimosoideae of Fabaceae than to any other putative relative. Similarity index values for all are quite low and the suggested relationship between Crossosomataceae and Fabaceae must remain provisional.

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