Phytochemistry, 1980, Vol. 19, p. 982. Pergamon Press Ltd. Printed in England.

ASTRINGENT TANNINS OF *COSMOS BIPINNATUS**

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(*Received* 29 *September* 1979)

Key Word Index—*Cosmos bipinnatus*; Compositae; tannin; extractability; astringency; procyanidin; haemanalysis; predation.

The presence of procyanidin in the leaves of *Cosmos bipinnatus* [1] is confirmed. This is unique among the Compositae (up to the present) in containing proanthocyanidins, and it is therefore important to know whether there are any peculiarities in the kind of proanthocyanidin present, and especially whether its presence is associated with astringency in the leaves.

Astringency is measured both in the powdered leaf and in the 50% MeOH extract of the powder by precipation of blood protein (haemanalysis [2]) and is expressed in terms of the per cent of tannic acid giving equal precipitation (TAE). Proanthocyanidin is measured [3] by heating the powder or the extract in 5% butanolic HCl. The level of proanthocyanidin is expressed in terms of the extinction coefficient ($E^{1\%}_{1cm}$) of the anthocyanidin produced at the maximum of the absorption curve, that of cyanidin being 547 nm and that of delphinidin 558 nm. The actual per cent of anthocyanidin cannot be determined unless the molecular complexity of the proanthocyanidin is known [3], but the E value gives some indication of the order of magnitude of the proanthocyanidin present. The ratio of the E value of the extract to that of the powder gives a measure of the extractability of the tannin, which is an important factor in determining the astringency experienced when the tissue is consumed or of its effectiveness in defence against predators.

The values determined for leaves of *C. bipinnatus* harvested in September from a plant grown from commercial seed (single flowers varying in colour from white to blue–crimson, the present sample blue–crimson) were as follows:

	Powder	Extract	Ratio extract/powder
TAE	3.5%	3.8%	
$E^{1\%}_{1cm}$	25	9	0.36
λ_{max}	547 nm	547 nm	

The astringency must be considered low; the TAE value for a moderately astringent species would be about 10%. But the E value of the powder is high, the low level of astringency being due to low extractability of the tannin, shown in both powder and extract. (It is lower than the lowest value recorded for species containing procyanidin [3], but those containing prodelphinidin, which is absent from this species, are often lower.) Otherwise there is nothing remarkable about the procyanidin, as such. It is, however, interesting that the leaves of *C. bipinnatus* are exceptionally fragrant and attractive, quite unlike the rank odour of many of the Compositae, which presumably in this family acts as a chemical defence against predators. It is tempting to speculate that the presence of tannin is, in fact, a compensation for the absence of the deterrent commonly employed by other members of this family.

*Part 4 in the Series "Astringency of Leaves". For Part 3 see Bate-Smith, E. C. (1978) *Phytochemistry* **17**, 1945.

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