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**SHORT COMMUNICATION**

# Production of flavonoids in plant parts of *Prosopis cineraria*

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Nutritional information is used increasingly by public agencies and agricultural industries to promote fresh produce. Consumers are looking for variety in their diets and are aware of the health benefits of fresh fruits and vegetables. Of special interests are food source rich in antioxidants like flavonoids. In addition to meeting nutrient intake levels, greater consumption of fruits and vegetables is associated with stroke, and cancers of mouth, pharynx, oesophagus, lungs and colon. Flavonoids are common constituents of many plant species which impart color to flowers and fruits and correlation between flower colour and attraction of insects for pollination is well known. Flavonoids have many biological effects including anti-allergic, anti-anginal, anti- inflammatory, anti-hepatoxic, anti-ulcer, anti-viral and anti-spasmolytic and are of interest in the investigation of disease processes and potential drugs.

*Prosopis cineraria* (Mimosaceae) locally called khejri, is a boon to the people due to its myriad virtues. It distributes discontinuously in dry and semidry regions. This tree provides fodder, fuel, timber and also has nitrogen fixing ability with micro symbiotic affinity. Its unripped pods (Sangri) are used for preparation of curies and pickles. This plant is used in pregnancy as a safeguard against miscarriage. The smoke of leaves is good for eyes troubles. The bark is used as a remedy for rheumatism, cough common cold, asthma and scorpion sting (Rastogi and Mehrotra, 1995; Bhatacharjee, 2001). Endogenous production of flavonoids has been reported in various arid zone plants (Saleh *et al*, 1982; Singh *et al*, 1988), *Dalbergia louvelli* (Beldjoudi *et al*, 2003), *Centaurea napifolia* (Akkal *et al*, 2003) and *Vigna aconitifolia cultivars* (Tyagi and Nag, 2004).

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As fruit (Sangri) of *P.cineraria* is among widely consumed vegetables in arid zone of India and to authors' knowledge there has been no systematic study on the flavonoids of sangri, the aim of present study was to quantify the amount of flavonoid in various parts of *P. cineraria* to see if the consumption of this plant will provide the recommended intake and also to find out which plant part has higher amount of flavonoid content.

*Prosopis cineraria* (L.) Druce plant parts such as roots, shoots, pods with seeds and pods without seeds as identified and authenticated by taxonomist, collected at their luxuriant growth from Central Institute of Arid Hotriculture, Bikaner (Rajasthan) India, were dried, powdered and used for estimation of flavonoid content.

**Isolation of flavonoids**

All the dried tissues were separately extracted in a Soxhlet with hot ethanol (Et OH) (Subramanian and Nagrajan, 1969) (100 ml/g dry weight of tissue) and filtered. The filtrate was dried *in vacuo* and the residue extracted with petroleum ether, ethyl ether ($Et_2O$) and ethyl acetate (EtOAc) in succession. The $Et_2O$ fraction was analysed for free flavonoids while the EtOAc fraction was hydrolyzed to cleave glycosides by refluxing with 7% $H_2SO_4$ (30ml) for 2 hours. The mixture was filtered, the filtrate extracted with EtOAc, neutralized with 5% NaOH, then dried *in vacuo* and analyzed for flavonoids.

**Identification of flavonoids**

The isolates were examined by TLC (Slica gel G coated plates) along with standard reference compounds, apigenin, isorhamnetin, isovitexin, kaempferol, luteolin, myricetin, quercetin, vitexin and esculetin. The plates developed in n-butanol-acetic acid-water (4:1:5, upper layer) were seen under uv light, placed in a chamber saturated with $NH_3$, and were sprayed separately with 5 % ethanolic ferric chloride solution. Each of the isolates were purified by preparative TLC (in a similar solvent system as for TLC). Isolates (each spot separately) were eluted with EtOAc and crystalized from $CHCl_3$. The purified isolates were subjected to mp, mmp, uv and ir spectral studies for identification.

**Quantification of flavonoids**

The quantitative estimation of the flavonoids was carried out colorimetrically (Kariyone *et al.*, 1953; Naghski *et al*., 1975; Mabry *et al*., 1970).

Flavonoids isolated were identified as quercetin (Rf.0.82, uv fluorescent-bluish yellow, $NH_3$-yellow, $FeCl_3$- bluish grey, mp=309°- 311°C, uv max-258,303,375 nm in ethanol) and Kaempferol (Rf-0.93, uv fluorescent- bright yellowish blue, $NH_3$-deep yellow, $FeCl_3$- brownish, mp= 271° 272°C, uv max 263, 324, 368 nm in ethanol) The characteristic ir spectral peaks were found to be superimposable with those of their respective standard reference compounds of quercetin and kaempferol.

The quantity of isolated quercetin and kaempferol in various plant parts is represented in Table 1. The total flavonoid content was found to be maximum (2.23mg/gdw) in the roots of *P.cineraria* and minimum (0.86mg/gwd) in the shoot. Among all the plant parts analyzed, roots showed the maximum kaempferol (0.97mg/gdw) and quercetin (1.26mg/gdw) while shoot showed minimum amount of kaempferol (0.24mg/gdw) and quercetin (0.62mg/gdw) however the concentration of these flavonoids in fruits was close to roots. In fruits the amount of these compounds was found to be more than the shoot but less than the roots.

Beldjoudi *et al* (2003) isolated four new flavonoids along with thirteen known compounds from heartwood or *Dalbergia louvelli* whereas Akkal *et al*., (2003) identified quercetin alongwith other four flavonoids from aerial parts of *Centaurea napifolia*. Yang *et al* (2003) reported eleven flavonoids including querectin and kaempferol from *Theobroma grandi florum* while Tyagi and Nag (2004) isolated and identified querectin and kaempferol from seeds and leaves of *vigna aconitifolia* cultivars.

It is suggested that plants of arid zone have biosynthetic potential to produce flavonoids in different plant parts which is regarded as one of the essential constituent of antioxidants. Although flavonoids research has been ongoing for couple of years, the work in the last five years has led to a vast increase in authors understanding of this familiar group of secondary metabolite.

Table 1. Flavonoid content from *Prosopis cineraria*

| Flavonoid | Concentration (mg/gdw) | | | |
|---|---|---|---|---|
| | Root | Shoot | Fruit with seeds | Fruit without seeds |
| Kaempferol | 0.97 | 0.24 | 0.82 | 0.68 |
| Quercetin | 1.26 | 0.62 | 1.12 | 0.97 |
| Total | 2.23 | 0.86 | 1.94 | 1.65 |

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