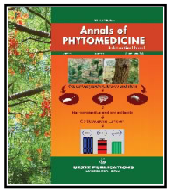
Annals of Phytomedicine 11(1): 523-529, 2022

DOI: http://dx.doi.org/10.54085/ap.2022.11.1.60

Annals of Phytomedicine: An International Journal

http://www.ukaazpublications.com/publications/index.php

Print ISSN : 2278-9839 Online ISSN : 2393-9885



Original Article : Open Access

Phytochemical screening and determination of total phenols, flavonoids and micronutrients of floral and leafy parts of *Prosopis cineraria* (L.) Druce (Angiosperms: Fabaceae)

Suman◆, Parvesh Devi, Sheetal and Sushila Singh

Department of Chemistry, CCS Haryana Agricultural University, Hisar-125004, Haryana, India

Article Info

Article history

Received 17 January 2022

Revised 5 March 2022

Accepted 6 March 2022

Published Online 30 June 2022

Keywords

Prosopis cineraria (L) Druce

Total phenolics

Flavonoids

Extract

Mineral content

Abstract

Prosopis cineraria (L.) Druce parts of flower and leaf were extracted with hot methanol and fractionated into different solvents. These extracts were used to evaluate total phenolic, flavonoids and mineral contents. Various phytoconstituents like saponins, tannins, carbohydrates, flavonoids, alkaloids, cardiac and anthraquinone glucosides, terpenoids, phytosterols, proteins, amino acids and fat and fixed oil have been screened in different fractions of flower and leaf parts of *P. cineraria*. The present work, therefore, attempts to report necessary preliminary phytochemicals screening and standard parameters for flower and leaves of *P. cineraria* which will help in determination of total phenolic, flavonoids and mineral contents. Total phenolic contents were highest in methanol fraction of flower (504.09 ± 0.83 mg $GAEg^{-1}$) while total flavonoid contents were highest in acetone fraction of flower also (456.77 ± 0.40 mg CEg^{-1}). *P. cineraria* possess highest N (3575 ± 0.11 mg/100 g) in ethyl acetate fraction of floral part, followed by K content (923 ± 0.01 mg/100 g) in acetone fraction of leafy part, P content (550 ± 0.12 mg/100 g) in hexane fraction of flower part, Fe content (403.60 ± 0.02 mg/100 g) in chloroform fraction of flower also, Cu content (50.85 ± 0.01 mg/100 g) in aqueous fraction of leaf part, Zn content (43.14 ± 0.06 mg/100 g) in acetone fraction of leaf and Mn content (14.35 ± 0.09 mg/100 g) in aqueous fraction of leaf also.

1. Introduction

India is more famous for its traditional herbal medicines and their presence is well documented in Ayurveda, Siddha and Unani. World Health Organization (WHO) has identified and listed 21,000 plants, which are used as a medicinal purpose (Singh *et al.*, 2020). But, all living systems require minerals and inorganic constituents for sustained normal life also. Unlike other nutrients, minerals cannot synthesize by living organisms or animals by acquiring adequate amount of required elements for their survival in environment (Khan *et al.*, 2012). The bioactive phytochemicals in plants especially fruits have been associated with numerous health benefits that are used as ingredients in many pharmaceutical and nutraceutical products in today life (Lachance and Das, 2007). But some time, the regular consumption of these plant-based food, *i.e.*, bioactive compounds like protein, carbohydrates, fiber, and numerous phytochemicals which are associated with fewer digestive disorders, reduced colon cancer rate as well as better control of sugar level and lower blood cholesterol levels also (Munika and Hymavathi, 2021). Plant fruits play a significant role in the human beings and animals health's by providing carbohydrates, fats, proteins, minerals and vitamins (Dahot, 1993).

Corresponding author: Dr. Suman

Department of Chemistry, CCS Haryana Agricultural University, Hisar-125004, Haryana, India

E-mail: sumansuthar88@gmail.com

Tel.: +91-8168551030

Prosopis (*Prosopis* spp.) is an underutilized legume plant that comprises approximately forty-four species and mainly distributed in arid, semiarid and subtropical regions (Zhong *et al.*, 2022). It is a native species of deserts of Western and South Asia, including Afghanistan, Iran, India and Pakistan has been revered in ancient writing in Sanskrit. *P. cineraria* synonymous with *P. spicigera* is wonder and useful species of Leguminosae family and Mimosaceae sub-family and it is locally known as Khejri, Jandi, Sangri and Janti in Rajasthan state and Kandi in Sindhu and Sumri in Gujarat state (Khandelwal *et al.*, 2016). It is state tree of Rajasthan which provides fodder from foliage, vegetable from pods and fuel from the pruned branches. Khejri is the most important feed species providing nutritious and good appetizing green and dry fodder, mainly eaten by camels, goats and sheep in desert areas. It is very famous and popular tree of Rajasthan. It is also known as 'Wonder or Golden tree' and the 'King of Desert' (Tarachand *et al.*, 2012). The *P. cineraria* plant play a vital role in socio-economic development of the farmers by not only boosting the growth and productivity of companion plants but also providing fuel, fodder, food, small timber, gum, tannins and various type of medicinal importance (Kumari *et al.*, 2021).

Leaf extract of this plant is used for the treatment of boils and blisters, which includes mouth ulcer in livestock (Khandelwal *et al.*, 2016). *P. cineraria* leaves have contained high nutritional contents like carbohydrates, protein, fat, minerals, vitamins and medicines which commonly known as "Loong" (Pathak and Kumar, 2017). Leaves smoke is best remedy for the cure of eye problems (Malik and Kalidhar, 2007). For hair removal therapeutic treatment of rubbing

of bark ashes of khejri is the most popular amend. The fresh leaf juice of jandi mixed with lemon juice is a famous therapy for curing of dyspepsia and crushed pods are the most useful for toothache and pain relief from fractured bones (Garg and Mittal, 2013). Floral part of *Prosopis* species are useful for honey production and its mixture with sugar acts as protection against miscarriage during pregnancy (Sharma *et al*., 2010). Therefore, the present study was aimed to screen the various phytoconstituents from flower and leaves of *P. cineraria* and determination of total phenolic contents (TPC), total flavonoid contents (TFC) and mineral contents.

2. Materials and Methods

2.1 Chemicals and equipment

Folin-ciocalteau reagent, catechin, gallic acid, aluminium chloride, disodium nitrate, disodium sulphate, sodium hydroxide, sodium acetate, butylated hydroxyl anisole (BHA), neseller's reagent, sodium silicates, 2,4-dinitrophenol (DNP), ammonium vandate, ammonium molybdate and potassium iodide and various solvents, *i.e.*, benzene, chloroform, ethanol, methanol, ethyl acetate, hexane and petroleum ether issued for this work were of analytical grade and purchased from CDH, Daryaganj, New Delhi or SD Fine Chem. Limited, Mumbai.

2.2 Collection of plant material

Floral and leafy parts of *Prosopis cineraria* (L.) Druce were procured in the month of February to April and July to October from campus of CCS HAU, Hisar and sidewise area of Haryana state (India). The plant was identified and authenticated by botanist Dr. R. M. Kadam, Department of Botany, Mahatma Gandhi Mahavidhyalaya, Latur, Maharashtra, India by voucher specimen number -DI 15. These collected plant samples were washed with fresh water and shadow dried. Then chopped into small pieces and stored in airtight containers for future use.

2.3 Preparation of extract/fractions

Plant samples of *P. cineraria*, *viz*., flower and leaf were extracted under refluxing method by using hot methanol for eight hours and the process was repeated thrice, then pooled together. The extractives were evaporated by rotatory evaporator to give crude extract, which was further fractionated into various solvents, *i.e*., hexane, benzene, chloroform, ethyl acetate, acetone and water. These obtained fractions were evaporated to get crude mass and stored in a cooled placed till use.

2.4 Phytochemicals screening

The freshly prepared methanolic extracts of flower and leaf of *P. cineraria* were used for examining the qualitative determination of phytochemicals using standard parameters. This was help in identification of various class of bioactive analysis.

2.5 Estimation of total phenolic contents (TPC)

The various fractions of *P. cineraria* used for the determination of total phenolics by using standard method, *i.e*., Folin-Ciocalteau reagent (Hossain *et al*., 2013). As a reference, standard 2.5-100 µg/ml gallic acid was used for plotting calibration curve and 1 ml of each plant fraction (1 mg/ml) was mixed with 1ml of 1N Folin- Ciocalteau reagent by adding 1 ml of saturated solution of 20 % sodium carbonate to make final volume up to 10 ml using distilled water. The reaction mixture was kept in dark place at room temperature for color development. The absorbance was measured at 725 nm wavelength by using UV-Visible spectrophotometer. By using linear regression equation, the amount of total phenolics was measured which obtained from standard curve of gallic acid. The total phenolic contents was calculated as mean ± standard deviation (SD) and expressed as mg/g gallic acid equivalent (GAE) of dry extract.

2.6 Estimation of total flavonoid contents (TFC)

The total flavonoids was determined by aluminium chloride colorimetric assay (Marinova *et al*., 2005) and catechin used as a reference standard to plot calibration curve. Briefly, 10 mg of catechin was dissolved in 100 ml distilled water for dilution and give various concentrations, *i.e*., 2.5, 5, 10, 20, 40, 60, 80 and 100 µg/ml. In 1 ml of each fraction and standard catechin were mixed separately with 4 ml of distilled water, then add 0.3 ml of 5% sodium nitrate and 0.3 ml of 10% aluminium chloride in 10 ml volumetric flask. After five minutes, added 2 ml of 1M sodium hydroxide solution and the final volume was made upto the mark with distilled water. The absorbance was measured at 510 nm on UV-Visible spectrophotometer against blank containing all reagents expect plant sample. The quantity of flavonoids was calculated as mean ± standard deviation and expressed as mg/g catechin equivalent (CE) of dry extract.

2.7 Estimation of mineral contents

Micronutrients like Fe, Cu, Zn, Mn were determined by using Atomic Absorbance Spectrophotometer. The samples were digested by wet oxidation process. 0.5 g of each plant fraction was taken and 20 ml of diacid (HNO_3: $HClO_4$ – 4:1) was added to each and kept for overnight. Next day, the samples were digested on hot plate then made final volume up to 25 ml using distilled water. The reading was taken by AAS against a blank. The mineral content was determined by using the following formula and expressed as mg/100 g of the extract:

$$\text{Mineral content} = (\text{Abs}_{\text{Sample}} - \text{Abs}_{\text{Blank}}) \times \text{Dilution factor}$$

For determination of nitrogen, phosphorus and potassium, the plant fractions were digested by following procedure as described above, but instead of 20 ml HNO_3: $HClO_4$ – 4:1, 10 ml of H_2SO_4: $HClO_4$ – 4:1 diacid mixture was used. Nitrogen content was determined by colorimetric (Nesseler's reagent) method (Lindner, 1944). 0.2 ml of each plant digest was taken in 25 ml volumetric flask, then added 0.5 ml of 10% sodium hydroxide and 1 ml of 10% sodium silicate in it. For color development, 1ml of Nesseler's reagent was added to each flask, then made final volume upto mark. The absorbance of the samples was read at 440 nm using spactronic20 UV-Visible spectrophotometer against a blank. The concentration of nitrogen was measured by using standard curve of ammonium sulphate and expressed in mg/100 g (Rafael *et al*., 2013).

The content of phosphorus was determined by using Vanado-molybdo - phosphoric yellow color method (Koenig and Johnson, 1942). Taken 2 ml of plant digest in volumetric flask, then add 1-2 drops of 2, 4-dinitrophenol and ammonia solution till yellow color is developed. After color development, added HCl drop wise till it become colorless, then added 5 ml of ammonium molybdate-vandate solution in each flask. Final volume was made upto the mark and recorded absorbance at 440 nm by using blue filter on spactronic20 spectrophotometer against a blank. The potassium content was determined in acid digest of plant by using flame photometer against a blank. The concentration of potassium measured in mg/100 g by using standard curve of potassium chloride.

3. Results

3.1 Phytochemicals screening

The methanolic extract of flower and leaf parts of *P. cineraria* were screened for the detection of various phytochemical components by using standard phytochemical parameters. The extracts were tested for saponins, tannins, carbohydrates, cardiac glycosides, alkaloids, flavonoids, terpenoids and fat and fixed oil, phytosterols, proteins, amino acids and anthraquinone glycosides are presented in (Table 1) (Rathore *et al*., 2019).

Table 1: Results of preliminary phytochemical screening in methanolic extract of flower and leaf of *P. cineraria*

Phytochemical test	Name of the test	Flower extract	Leaf extract
Saponins	Frothing test	+	+
Tannins	Ferric chloride test	+	+
Carbohydrates	Fehling's test, Tollen's reagent test	+	+
Cardiac glycosides	Keller-Killiani test	+	-
Anthraquinone glycosides	Hydroxyanthraquinine test	-	-
Alkaloids	Hager's test	+	+
Flavonoids	Alkaline reagent test	+	+
Terpenoids	Salkowski test	+	-
Phytosterols	Liebermann- Burchard's test	-	+
Protein	Biuret test	-	+
Amino acids	Millon's test	-	+
Fats and fixed oil	Copper sulphate test	-	-

+ sign shows the presence while – sign shows the absence.

3.2 Total phenolic contents (TPC)

Phenolics present in plants are carbon based aromatic compounds which play vital role in the health of human beings. It possessed a wide spectrum of biochemical activities. Therefore, the different fractions of *P. cineraria* flower and leaf were screened for total phenolic contents (Table 2). The TPCs of various fractions was expressed in terms of gallic acid equivalent (GAE) and calculated using the linear regression equation obtained from standard plot of gallic acid.

Table 2: Total phenolic contents (TPC) of *P. cineraria* plant fractions

Sr. No.	Extract/fractions	Flower	Leaf
1.	Hexane	028.67 ± 0.04	177.97 ± 0.84
2.	Benzene	152.08 ± 0.73	134.58 ± 0.85
3.	Chloroform	205.13 ± 0.76	213.18 ± 1.65
4.	Ethyl acetate	403.15 ± 0.85	292.30 ± 0.80
5.	Acetone	255.09 ± 0.82	256.52 ± 0.82
6.	Methanol	504.09 ± 0.83	271.79 ± 0.79
7.	Water	147.94 ± 0.81	106.04 ± 1.66

All values are mean ± S.D.
mg/g GAE/g - milligram of gallic acid equivalent per gram

3.3 Total flavonoid contents (TFC)

Flavonoids are the most important group of polyphenolics in human diet which is usually found in plants. Thus, the total flavonoid contents of different fractions of *P. cineraria* flower and leaf were determined and expressed in terms of catechin equivalent (CE). The TFCs were calculated using the following linear regression equation obtained from the standard plot of catechin.

Table 3: Total flavonoid contents (TFC) of *P. cineraria* plant extracts

Sr. No.	Extract/fractions	Flower	Leaf
1.	Hexane	134.34 ± 0.81	208.31 ± 0.98
2.	Benzene	222.75 ± 0.64	215.99 ± 0.36
3.	Chloroform	234.17 ± 0.92	245.08 ± 0.85
4.	Ethyl acetate	420.23 ± 0.40	316.05 ± 0.40
5.	Acetone	456.77 ± 0.40	404.94 ± 0.40
6.	Methanol	208.31 ± 0.98	178.95 ± 0.36
7.	Water	205.11 ± 0.60	153.06 ± 0.38

All the values are mean ± S.D.
mg/g CE/g- milligram of catechin equivalent per gram

3.4 Mineral contents

P. cineraria is one of the chief indigenous trees of the plains and the most important source of medicinal and nutritional area which play vital role in many healing benefits and feeding processes. Therefore, this plant has most valuable property then it is used for estimation of mineral contents of various fractions of *P. cineraria* parts. The results revealed that *P. cineraria* possessed the highest nitrogen (N) content, followed by potassium (K), phosphorus (P), iron (Fe), copper (Cu), zinc (Zn), and manganese (Mn) content (Rafael *et al*., 2013; virginia, 1986).

Table 4: Mineral contents (mg/100 g) of flower fractions of *P. cineraria*

Sr. No.	Fractions	Iron (Fe)	Copper (Cu)	Zinc (Zn)	Manganese (Mn)	Nitrogen (N)	Phosphorus (P)	Potassium (K)
1.	Hexane	045.15 ± 0.07	00.10 ± 0.01	05.86 ± 0.01	00.40 ± 0.06	2187 ± 0.08	550 ± 0.12	133 ± 0.08
2.	Benzene	150.60 ± 0.04	05.35 ± 0.08	17.21 ± 0.07	00.30 ± 0.03	2625 ± 0.01	374 ± 0.08	293 ± 0.03
3.	Chloroform	403.60 ± 0.02	07.50 ± 0.02	22.26 ± 0.03	00.20 ± 0.01	2775 ± 0.21	450 ± 0.09	358 ± 0.05
4.	Ethyl acetate	088.30 ± 0.01	13.35 ± 0.09	17.76 ± 0.09	00.15 ± 0.11	3575 ± 0.11	267 ± 0.03	114 ± 0.02
5.	Acetone	020.30 ± 0.09	00.75 ± 0.04	17.16 ± 0.01	00.10 ± 0.08	ND	287 ± 0.00	157 ± 0.00
6.	Methanol	037.95 ± 0.01	09.15 ± 0.02	03.56 ± 0.09	00.20 ± 0.01	ND	375 ± 0.11	229 ± 0.08
7.	Water	034.60 ± 0.03	00.50 ± 0.01	06.14 ± 0.05	00.10 ± 0.02	ND	525 ± 0.09	192 ± 0.01
	SE(d)	1.772						
	CD at 5%	3.837						
	CV%	1.927						

All the values are mean ± S.D.
ND - Not determined

Table 5: Mineral contents (mg/100 g) of various fractions of leaves of *P. cineraria*

Sr. No.	Fractions	Iron (Fe)	Copper (Cu)	Zinc (Zn)	Manganese (Mn)	Nitrogen (N)	Phosphorus (P)	Potassium (K)
1.	Hexane	178.60 ± 0.01	07.45 ±0.05	33.26 ± 0.70	09.65 ± 0.90	1862 ± 0.01	487 ± 0.09	167 ± 0.11
2.	Benzene	116.50 ± 0.09	10.10 ± 0.41	20.50 ± 0.05	00.45 ± 0.04	2700 ± 0.10	505 ± 0.19	271 ± 0.04
3.	Chloroform	245.20 ± 0.01	27.55 ± 0.09	14.95 ± 0.11	01.00 ± 0.11	2325 ± 0.11	450 ± 0.18	114 ± 0.07
4.	Ethyl acetate	299.20 ± 0.05	13.09 ± 0.11	15.76 ± 0.01	00.70 ± 0.03	3025 ± 0.05	402 ± 0.01	181 ± 0.09
5.	Acetone	126.60 ± 0.04	11.45 ± 0.02	43.14 ± 0.06	00.90 ± 0.01	2625 ± 0.08	412 ± 0.18	923 ± 0.01
6.	Methanol	66.85 ± 0.11	00.45 ± 0.02	29.24 ± 0.09	07.60 ± 0.08	ND	525 ± 0.65	171 ± 0.90
7.	Water	345.25 ± 0.09	50.85 ± 0.01	31.12 ± 0.07	14.35 ± 0.09	ND	450 ± 0.07	218 ± 0.05
	SE(d)	3.883						
	CD at 5%	8.405						
	CV%	2.432						

All the values are mean ± S.D.
ND - Not determined

4. Discussion

4.1 Preliminary phytochemical screening

Plants are well known for presence of its significant amount of free radical scavengers such as phenols, flavonoids, saponins, glycosides and terpenoids and these play important role as a plant antioxidant (Malik *et al*., 2020). So, major preliminary phytochemicals were screened in the methanolic extract of flower and leaf of *P. cineraria*. Both flower and leaves extract showed the presence of saponins, tannins, carbohydrates, alkaloids, flavonoids. But, phytosterols, protein and amino acid gives positive response in leaves and negative response in flower extract. Fats and fixed oils give negative result in both flower and leaves of *P. cineraria*. Terpenoids and cardiac glycosides present in flower and anthraquinone glycosides present in leaf extract.

4.2 Total phenolic contents

Phenolics are good source for discovery of pharmaceutical compounds and medicines. As a source of medicines, medicinal plants have been playing important role in health gesture around the world (Mohan *et al*., 2017). A perusal data resulted that methanolic fraction of flower and ethyl acetate fraction of leaves of *P. cineraria* contained maximum amount of phenolics, *i.e*., 504.09 ± 0.83 mg GAEg^{-1}and 292.30 ± 0.80 mg GAEg^{-1}. Hexane fraction of flower and aqueous fraction of leaves contained very low amount of total phenolics, *i.e*., 28.67 ± 0.04 mg GAEg^{-1} and 106.04 ± 1.66 mg GAEg^{-1}. A comparative analysis of various fractions of flower and leaf extracts shown in Figure 1. Among all these fractions, it is overall concluded that methanol fraction has highest amount of total phenolic contents (Rathore *et al*., 2019).

4.3 Total flavonoid contents

Flavonoids are low molecular weight of polyphenolic type secondary metabolites, widely distributed throughout in green plants and prokaryotes. These flavonoids are remarkable reactive oxygen species scavengers and continuously fight against polluted atmosphere (Samanta *et al*., 2011). It also scavenges photo produced active oxygen species. The present data reported in Table 3 revealed that hexane

fraction of flowers extract contained minimum amount of flavonoids, *i.e.*, 134.34 ± 0.81 mg CEg^{-1} and acetone fraction contained maximum amount of flavonoids, *i.e.*, 456.77 ± 0.40 mg CEg^{-1}. Leaves of *P. cineraria* contained second maximum amount of flavonoids in acetone fraction (404.94 ± 0.40 mg CEg^{-1}) and minimum amount in aqueous fraction (153.06 ± 0.38 mg CEg^{-1}). A comparison of the data present in Figure 2 showed that among all fractions of flower and leaf extract of *P. cineraria*, acetone fraction was found to be highest amount of total flavonoids (Rathore *et al.*, 2019).

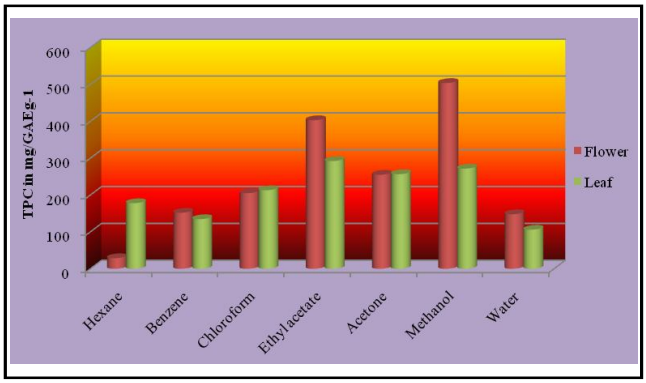


Figure 1: Total phenolic contents (mgGAg^{-1}) of various fractions of *P. cineraria*.

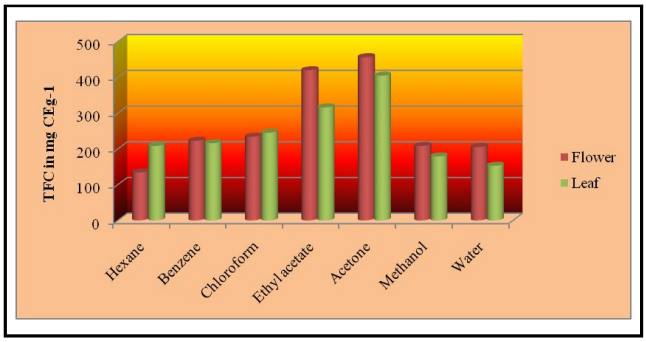


Figure 2: Total flavonoid contents (mg CEg^{-1}) of various fractions of *P. cineraria*.

4.4 Comparative bio evaluationof nutritional content of various fractions of *P. cineraria*

Flowers of *P. cineraria* are rich source of minerals and antioxidants. The data presented in Table 4 examined that flower of khejri plant contained highest amount of nitrogen content in ethyl acetate fraction (3575 ± 0.11 mg/100 g) and lowest amount in hexane fraction (2187 ± 0.08 mg/100 g). Manganese has very low concentrations and its concentration ranged 00.10 ± 0.02 mg/100 g (water fraction) to 00.40 ± 0.06 mg/100 g (hexane fraction). Chloroform fraction of iron and ethyl acetate fraction of copper contained higher concentrations, *i.e.*, 403.60 ± 0.02 mg/100 g and 13.35 ± 0.09 mg/100 g while acetone fraction of iron and hexane fraction of copper contained lower concentrations, *i.e.*, 20.30 ± 0.09 mg/100 g and 00.10 ± 0.01 mg/100 g, respectively. Potassium content was ranging from 114 ± 0.02 mg/100g in ethyl acetate fraction to 358 ± 0.05 mg/100 g in chloroform fraction. Phosphorus concentrations in flower of *P. cineraria* varied from 267 ± 0.03 mg/100 g (ethyl acetate fraction) to 550 ± 0.12 mg/100 g (hexane fraction). So, overall concluded that mineral content present in flower in order of nitrogen (N) > phosphorous (P) > iron (Fe) > potassium (K) > zinc (Zn) > copper (Cu) > manganese (Mn).

Leaves of *P. cineraria* are highly nutritious as well as appetizing. They contained highest amount of nitrogen and phosphorous (Table 5), *i.e.*, 3025 ± 0.05 mg/100 g in ethyl acetate fraction and 525 ± 0.65 mg/100 g in methanolic fraction, respectively. Benzene fraction of leaves of *P. cineraria* contained Mn in lowest concentration, *i.e.*, 00.45 ± 0.44 mg/100 g while it was maximum in aqueous fraction, *i.e.*, 14.35 ± 0.09 mg/100 g. Zinc concentration was ranging from 14.95 ± 0.11 mg/100 g (chloroform fraction) to 43.14 ± 0.06 mg/100 g (acetone fraction). Potassium content in leaves varied from 114 ± 0.07 mg/100 g to 923 ± 0.01 mg/100 g in chloroform and acetone fractions. Methanolic fraction of Fe and Cu was found to be minimum concentrations, *i.e.*, 66.85 ± 0.11 mg/100 g and 0.45 ± 0.02 mg/100 g while water fraction was found to be maximum, *i.e.*, 345.25 ± 0.09 mg/100 g and 50.85 ± 0.01 mg/100 g, respectively. Leaves fractions contained mineral content in order of nitrogen (N) > potassium (K) > phosphorous (P) > iron (Fe) > copper (Cu) > zinc (Zn) > manganese (Mn) (Khan *et al.*, 2009). A comparative analysis of micronutrients was represented in Figures 3-9.

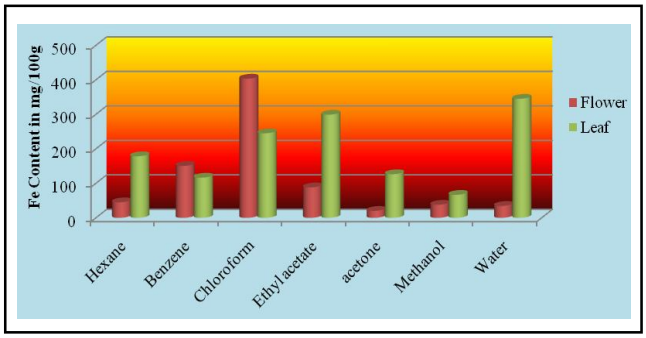


Figure 3: Iron content of various extract/fractions of *P. cineraria*.

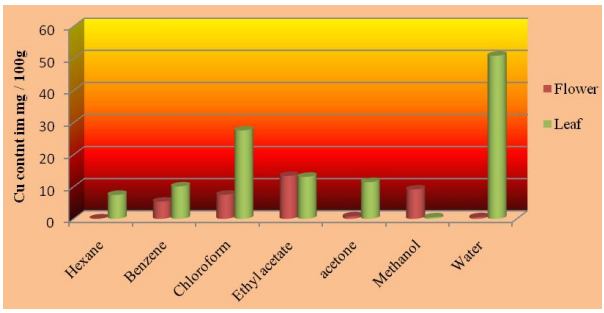


Figure 4: Copper content of various extract/fractions of *P. cineraria*.

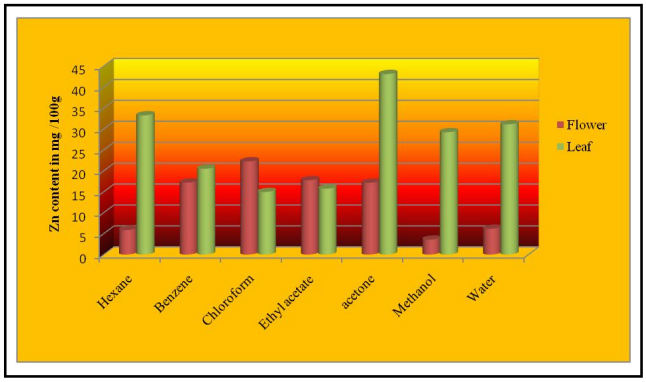


Figure 5: Zinc content in various extract/fractions of *P. cineraria*.

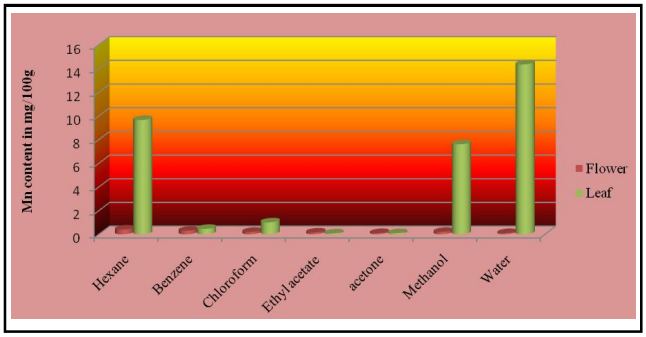


Figure 6: Manganese content of various extract/fractions of *P. cineraria*.

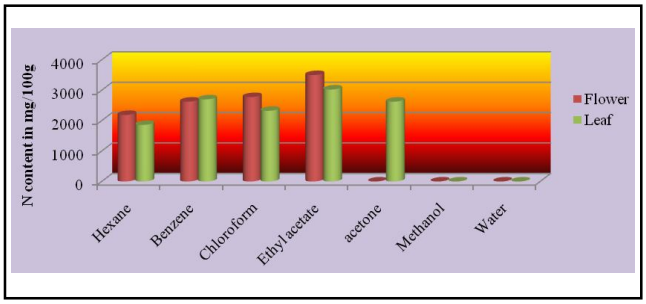


Figure 7: Nitrogen content of various extract/fraction of *P. cineraria*.

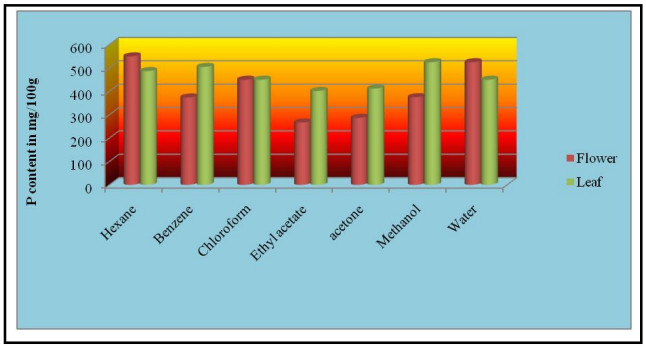


Figure 8: Phosphorous content of various extract/fraction of *P. cineraria*.

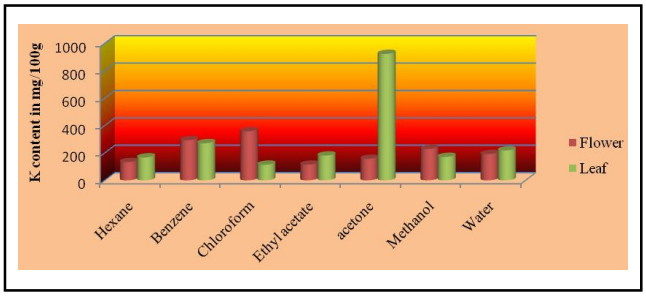


Figure 9: Potassium content of various extract/fraction of *P. cineraria*.

6. Conclusion

It was concluded that *P. cineraria* contain good amount of total phenols and flavonoids and act as a rich source of the micronutrients. Among different fractions, methanol fraction was found to offer the most efficient total phenolic and total flavonoid contents which reveals its potency as a good source of natural antioxidant. From our current investigation on nutritional evaluation of foliages of *P. cineraria* revealed that this plant has good source of nutrients and multifactorial medicinal properties can be used for treating various aliments without any side effects and also used as substrates deflect in either of these nutrients for livestock grazing in this region. However, further research is needed to identify individual components forming antioxidative systems and develop their application for food and pharmaceutical industries.

Acknowledgements

The authors acknowledge the support granted from Professor and Head, Department of Chemistry, CCS Haryana Agricultural University, Hisar, India for providing research facilities.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

References

Dahot, M.U. (1993). Free radicals, antioxidants and human disease: Curiosity, cause, or consequence. Lancent, **52**:253-265.

Garg, A. and Mittal, S. (2013). Review on *Prosopis cineraria*: A potential herb of Thar Desert. Drug Invention Today, **5**(1):60-65.

Hossain, M. N.; Al- Raqmi, K. A. S. ; Al- Mijizy, Z. H.; Weil, A. M. and Al-Riyami, Q. (2013). Study of total phenol, flavonoids contents and phytochemical screening of various leaves crude extracts of locally grown *Thymus vulgaris*. Asian Pacific J. Tropical Biomed., **3**(9): 705-710.

Khan, Z. I.; Ashraf, M.; Ahmad, K.; Ahmad, N.; Danish, M. and Valeem, E. E. (2009). Evaluation of mineral composition of forages for grazing ruminants in Pakistan. Pak. J. Bot., **41**(5):2465-2476.

Khan, Z. I.; Ahmad, K.; Danish, M. and Mirzaei, F. (2012). Minerals profile of forages for grazing ruminants in Pakistan. Int. J. Live stock Res., **2**(2):74-91.

Khandelwal, P.; Sharma, R. A. and Agarwal, M. (2016). Phytochemical analyses of various parts of *Prosopis cineraria*. Int. J. Pharm. and Chem., **2**(1):6-9.

Koenig, R. and Johnson, C. (1942). Colorimetric determination of phosphorus in biological materials.Indust. and Engn. Chem. Analyt. Edi., **14**(2): 155-156.

Kumari, B. and Solanki, H. (2021). An insight highlight story on the beneficial and phytochemical impact of *Prosopis cineraria* in Tonk, Rajasthan (India). Int. J. Bio. Innovat., **3**(2):257-263.

Lachance, P. A. and Das, Y. T. (2007). Nutraceuticals. Compr. Med. Chem. II., 1:449-461.

Lindner, R. C. (1944). Rapid analytical methods for some of the more common inorganic constituents of plant tissues. Plant Physio., **19**(1):76.

Malik, A. and Kalidhar, S. B. (2007). Phytochemical examination of *Prosopis cineraria* L. (Druce) leaves. Ind. J. Pharmaceut. Sci., **69**:576-578.

Malik, T.; Madan, V. K. and Prakash, R. (2020). Herbs that heal: Floristic boon to the natural healthcare system. Ann. Phytomed., **9**(2):1-9.

Marinova, D.;Ribarova, F. and Atanassova, M. (2005). Total phenolics and total flavonoids in Bulgarian fruits and vegetables. J. Uni. Chemi. Tech. and Metallurgy, **40**:255-260.

Mohan, G.; Anand, A. P. and Doss, A. (2017). Evaluation of antioxidant and antibacterial activity of leaf extracts of *Prosopis cineraria* (L.) Druce. Adv. J., **4**(3):1-4.

Mounika, M. and Hymavathi, T.V. (2021). Nutrient and phytonutrient quality of nutricereals incorporated flour mix suitable for diabetics. Ann. Phytomed., **10**(1):132-140.

Pathak, V. and Kumar, P. (2017). Phytochemical screening of *Prosopis cineraria* (L.) stem bark and leaves. Int. J. Inno. Sci. and Res. Tech., **2**(8):306-317.

Rafael, F. M.; Ramon, G. G.; Luis, M. C.; Irineo, T.; Juan, P. and Rosalia, V.O. (2013). A review of methods for sensing the nitrogen status in plants: advantages, disadvantages and recent Advances. Sensors, **13**:10823-10843.

Rathore, A.; Dadhich, R.; Purohit, K.; Sharma, S. K.; Vaishnava, C. S.; Joseph, B. and Khatri, A. (2019). Phytochemical screening and total phenolic and flavonoid content in leaves of *Prosopis cineraria* (L.) Druce. Int. J. Chemi. Stud., **7**(3):1853-1855.

Samanta, A.; Das, G. and Das, S. K. (2011). Roles of flavonoids in plants. Int. J.Pharmceu. Sci., **6**(1):12-35.

Sharma, N.; Garg, V. and Paul, A. (2010). Antihyperglycemic, antihyperlipidemic and antioxidant potential of *Prosopis cineraria* bark. Ind. J. Clinic. Biochem., **25**(2):193-200.

Singh, S.; Bajpai, M. and Mishra, P. (2020). Pharmacognostical evaluation of indigenous herbal drug: *Carissa carandus* Linn. Fruit. Ann. Phytomed., **9**(2):263-270.

Tarachand; Bhandari, A.; Kumawat, K. B.; Sharma, A., and Nagar, N. (2012). Physicochemical and preliminary phytochemicals screening of pods of *Prosopis cineraria* (L.) Druce. Der Pharmacia Sinica, **3**(3):377-381.

Virginia, R.A. (1986). Soil development under legume tree canopies. Forest Ecology and Management **16**:69-79

Zhong, J.; Lu, P.; Wu, H.; Liu, Z.; Sharifi-Rad, J.; Setzere, W. N. and Suleria, H. A. R. (2022). Current insights into phytochemistry, nutritional, and pharmacological properties of *Prosopis* plants. Evidence-Based Complem. And Alter. Med., pp:1-18.

Citation **Suman, Parvesh Devi, Sheetal and Sushila Singh (2022). Phytochemical screening and determination of total phenols, flavonoids and micronutrients of floral and leafy parts of *Prosopis cineraria* (L.) Druce (Angiosperms: Fabaceae). Ann. Phytomed., 11(1):523-529. http://dx.doi.org/10.54085/ap.2022.11.1.60.**