Pharmacogn. J.
A multifaceted peer reviewed journal in the field of Pharmacognosy and Natural Products
www.phcogfirst.com/phcogj

Original Article

Assessment of total phenolic, flavonoid, tannin content and phytochemical screening of leaf and flower extracts from *Peltophorum pterocarpum* (DC.) Backer ex K.Heyne: a comparative study

Peraman Muthukumaran*, Nachimuthu Saraswathy, Vijayasekar Aswitha, Ramesh Balan, Venkatesh Babu Gokhul, Palanikumar Indumathi and Sivasubramani Yuvapriya

Department of Biotechnology, Kumaraguru College of Technology, Coimbatore, Tamil Nadu, INDIA.

ABSTRACT

Introduction: Total phenolic, flavonoid and tannin content of leaf and flower extract of *Peltophorum pterocarpum* (DC.) Backer ex K.Heyne was compared. **Objective:** To explore total phenolic, flavonoid and tannin content of both leaf and flower extracts of *Peltophorum pterocarpum*(DC) K Heyne. **Method:** Initially, collected fresh leaves and flower samples were shade dried and extracted with various solvents such as aqueous methanol (1:1), ethyl acetate, ethanol and aqueous. Qualitative analysis was performed for various phytochemical. Thenthe total phenolic content, total flavonoid content and total tannin content was estimated. **Results:** In preliminary phyto-chemical examination of various solvent extracts of both leaf and flowers of *P. pterocarpum* revealed that the presence of various phyto-chemicals such as phlobatannins, terpenoids, alkaloids, saponins, tannin, reducing sugars, phenols and steroids. In phtyochemical evaluation, when compare with all other solvents, Ethanolic extracts shows maximum extractive value. In case of ethyl acetate, it shows very low extractive value in all three phyto-chemicals. In phytochemical evaluation studies, total phenolic content of leaves shows highest in ethanolic extract (33.17 ± 4.72 mg/g) and lowest in ethyl acetate extract from flower (4.71 ± 0.07 mg/g), Similarly, flavonoid content of leaves shows highest in ethanolic extract (1.43 ± 0.01 mg/g) and lowest in aqueous extract of flower (0.23 ± 0.09 mg/g) but in case of tannin content, flower extracts shows higher tannin content in ethanolic extract (844.59 ± 10.38 mg/g) whereas lowest tannin content in leaf ethyl acetate extract (9.54 ± 6.98 mg/g). **Conclusion:** This is first report of comparative studies on total phenolic, flavonoid and tannin content of various solvent extracts both leaves and flowers from *Peltophorum pterocarpum* (DC) K Heyne.

Key words: Phytochemicals, Phenolic content, Flavonoid, Tannin, *Peltophorum pterocarpum,* Solvent extraction.

Correspondence:
Mr. Peraman Muthukumaran, Asst. Professor-II, Department of Biotechnology, Kumaraguru College of Technology, Coimbatore, Tamil Nadu, INDIA-641 049.
Tel no: +04222669401; Fax no:+04222669406

E-mail: m.kumaran005@gmail.com
DOI: 10.5530/pj.2016.2.7

INTRODUCTION

Peltophorum pterocarpum (DC). Backer ex K. Heyne (Leguminosae) is commonly referred to as golden flamboyant. It is widely grown in tropical regions of South Eastern Asia, Sri Lanka, Thailand, Indonesia, Malaysia, Philippines and Australia.[1] A handsome tree, up to 24 m. in height, barks grey, smooth; leaves bipinnate: leaflets many, 10-30 pairs of leaflets are present which are oblong. The flowers are bright yellow coloured, nectar producing and shows axillary racemose inflorescence. It is used as astringent to cure intestinal disorder, used as pain relief after child birth, sprains, bruises and edema. It is also used as lotion for eye irritation, muscular pains andsores.[2] Different parts of this tree are used to treat many diseases like stomatitis, insomnia, skin troubles, constipation, ringworm and its flower extract is known to be a good sleep inducer and used in insomnia treatment.[3-5] Its bark is used as medicine for dysentery, as eye lotion, embrocation for pains and sores. The flowers and bark are also reported to have an antimicrobial activity.[6-7] Similarly, Flowers are used to treat insomnia and to induce good sleep.[8]

The leaf and bark of this plant reported to contain phenolic compounds that showed antibacterial, antioxidant and hypoglycemic activity.[9-12] Similarly, b-Sitosterol, a mixture of steroidal glycosides, lupeol, bergenin, and naringenin-7-glucoside has been reported from the flowers.[13-7] The traditional healers use the leaves in the form of decoction for treating skin disorders. Stem infusion of *Peltophorum pterocarpum* Baker ex K. Heyne used in dysentery, for gargles, tooth powder and muscular pain.[18] *P. pterocarpum* flowers showed promising antimicrobial activity against some medically important pathogenic bacteria and fungi.[2, 6, 9, and 19] An antioxidant and cardio tonic activities have also been reported from the flower[10,20]

Literature reviews indicated that previously, no studies combining the leaf and flowers especially, total phenolic, flavonoid and tannin content of the leaf and flowers of *Peltophorum pterocarpum*. In the present communication, we qualitatively explore the presence of phytochemicals such as alkaloids, flavonoids, steroids, glycosides, saponins, tannins and many other phyto-chemicals and evaluation of total phenolic, flavonoid content and tannin content of various extracts of both leaf and flowers from *Peltophorum pterocarpum* (DC.) Backer ex K. Heyne was compared.

MATERIALS AND METHODS

Collection and authentication of plant material

Fresh leaves and flowers were collected from healthy *P. pterocarpum* trees at Kumaraguru College of Technology, Coimbatore, Tamil Nadu, India campus medicinal garden during December 2013. The plant sample was identified to be *Peltophorum pterocarpum* by Botanical Survey of India, Tamil Nadu Agricultural University (TNAU), Coimbatore, Tamil Nadu, India (Reference no. BSI/SRC/5/23/201 3-14/Tech./1687). The leaf and flower samples were washed thoroughly with running water to remove the dirt from these samples. These samples were blotted dry with tissue papers.

Table 1: Preliminary phytochemical screening of various extracts of *Peltophorum pterocarpum* flowers

Phytochemicals	Aqueous Methanol	Ethyl acetate	Ethanol	Aqueous
Phenols	+	++	+	-
Steroids	-	-	-	-
Glycosides	-	-	+	-
Saponins	++	-	-	++
Flavonoids	+++	+	++	++
Phlobatannins	+	-	-	+
Terpenoids	+	+	+	+
Alkaloids	+	+	+	-
Reducing sugars	+	+	+	+

(+++) appreciable amount; (++) moderate; (+) trace amount; (-) completely absent.

Table 2: Preliminary phytochemical screening of various extracts of *Peltophorum pterocarpum* leaves

Phytochemicals	Aqueous Methanol	Ethyl acetate	Ethanol	Aqueous
Phenols	-	+	++	-
Steroids	-	-	-	-
Glycosides	-	-	+	-
Saponins	+	-	-	+
Flavonoids	++	+	+++	++
Phlobatannins	+	-	-	+
Terpenoids	+	+	++	+
Alkaloids	++	+	+	-
Reducing sugars	+	+	+	+

(+++) appreciable amount; (++) moderate; (+) trace amount; (-) completely absent.

Chemicals used

Aqueous-methanol, Ethyl acetate, Ethanol, 20% sodium carbonate, Aluminium chloride, 5% sodium nitrite, 5% $NaNO_2$, 8 mM potassium ferric cyanide, 20 mM ferric chloride, Folin ciocalteu phenol, Gallic acid, Tannic acid and Quercetin were used as standard. All the chemicals and reagents were purchased from Hi-Media.

Sample preparation

The collected and cleaned leaf and flower samples were shade dried for 3-4 days till samples were free from moisture. The dried samples were powdered using clean mechanical blender to obtain fine sized leaf and flower samples. Then 5 g of finely powdered leaf and flower samples of *P. pterocarpum* were extracted with aqueous: methanol (1:1), ethanol and ethyl acetate (150 ml each) separately using soxhlet extractor. Exhaustive extraction was done for 20 cycles in the extractor. The extracts were concentrated using flash evaporator and the concentrated extracts were stored in sealed eppendorf for further studies.

Preliminary phytochemical studies

The leaf and flower extracts of *P. pterocarpum*was subjected to qualitative phyto-chemical analysis. Presence of various phytochemicals such as phenols, steroids, glycosides, saponins, flavonoids, phlobatannins, terpenoids, alkaloids and reducing sugars were determined by various phytochemical tests.[21]

Estimation of total phenolic contents

Total phenolic content was estimated by the following method. Total phenolic content was estimated for aqueous methanol, aqueous, ethanol and ethyl acetate extracts of both leaf and flower extracts of *P. pterocarpum*. 20 µL of the extracts were made up to 1 mL with distilled water. 0.5 mL of freshly prepared Folin ciocalteu phenol reagent and 2.5 mL of 20% sodium carbonate were added respectively to each extract. The contents were agitated and left in dark for 40 minutes. The absorbance of the sample was read at 725 nm. Gallic acid was used as the standard. Amount of phenolic content was expressed as mg of Gallic acid per gram of plant tissue (mg GA/g).

Estimation of tannin content

100 µL of each flower and leaf extracts were made upto 7 mL with distilled water. 8 mM potassium ferric cyanide and 20 mM ferric chloride prepared in 0.1M hydrochloric acid were added respectively. The contents were mixed and optical density was measured at 700 nm. Tannic acid was used as standard. Tannin content was expressed as mg of tannin per gram of plant tissue (mg TA/g).

Estimation of total flavonoid content

Total flavonoid content was estimated by the method of Sathishkumar *et al.*[22] using Quercetin as standard. 0.1 mL of each flower and leaf extracts were taken and made up to 5 mL with distilled water. 0.3 mL of 5% $NaNO_2$ was added. 3 ml of 10% $AlCl_3$ was added after 5 minutes and were shaken well. 2 mL of 1M NaOH was added after 6 minutes and the absorbance was read at 510 nm. The results were expressed as mg quercetin/g of plant tissue.

RESULTS

Preliminary phytochemical test for extracts of leaves and flowers of Peltophorum pterocarpum.

Preliminary phyto-chemical analysis of various solvent extracts such as aqueous methanol, ethyl acetate, ethanol and aqueousextracts of leaf and flowers of *P. pterocarpum* revealed that the presence of various phyto-chemicals. It was found that steroids were absent in flowers and phlobatannins were absent in leaves of *P. pterocarpum* (Table 1 and 2).

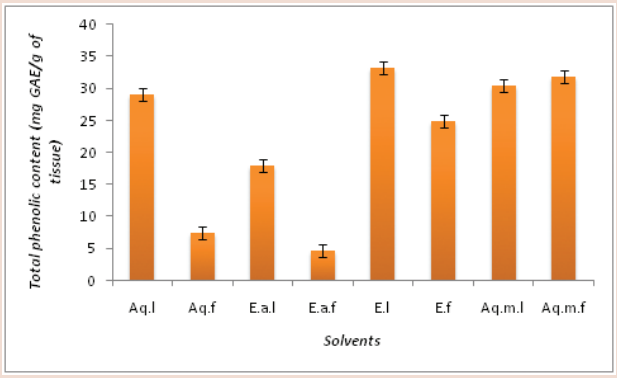


Figure 1: Total phenolic content of leaf and flowers of *Peltophorum pterocarpum* (DC.) K. Heyne

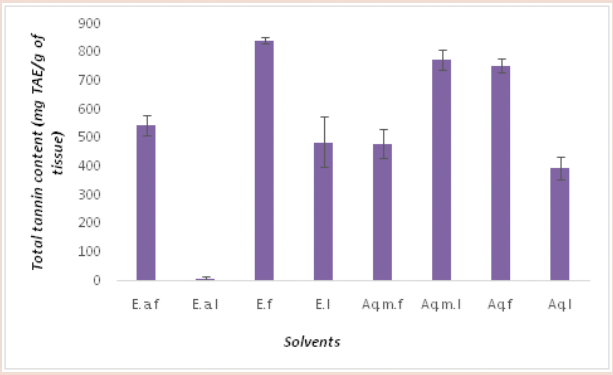


Figure 2: Total Tannin content of leaf and flowers of *Peltophorum pterocarpum* (DC.) K. Heyne

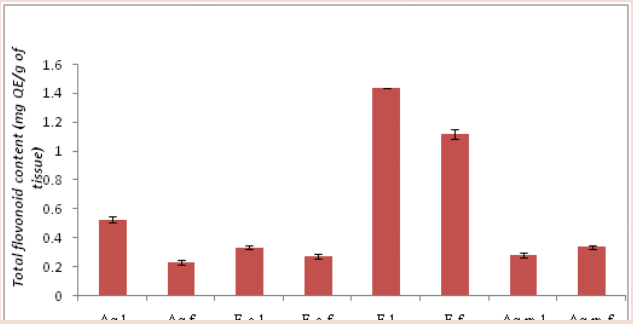


Figure 3: Total flavonoid content of leaf and flowers of *Peltophorum pterocarpum* (DC.) K. Heyne

Phytochemical evaluation

Total phenolic content

The total phenolic content was estimated using Gallic acid as standard. The total phenolic content was expressed as Gallic Acid equivalent (GAE)/g of tissue. Among four different extracts, ethanolic extract shows maximum phenolic content of 33.17 ± 4.72 mg and 24.91 ± 6.82 mg of GAE/g from leaf and flower respectively (Figure 1).

Results are expressed as means ± SD (n=3). Aq.l=Aqueous leaf; Aq.f =Aqueousflower; E.a.l=Ethyl acetate leaf; E.a.f=Ethyl acetate flower; E.l=Ethanol leaf; E.f=Ethanol flower; Aq.m.l=Aqueous Methanol leaf; Aq.m.f=Aqueous Methanol flower.

Tannin content

Total tannin content was estimated using tannic acid standard. Figure 2 Shows tannin content of various extracts of *Peltophorum pterocarpum* and expressed as tannic acid equivalent (mg tannic acid (TAE)/ g tissue).

Total flavonoid content

Total flavonoid content of the both flower and leaf extracts of *Peltophorum pterocarpum* found using quercetin standard. The flavonoid content in various extracts was given in Figure 3.

DISCUSSION

Preliminary phyto-chemical analysis of *P. pterocarpum* revealed that the presence of various phyto-chemicals such as Phlobatannins, Terpenoids, Alkaloids, Saponins, Reducing sugars and phenols, steroids and glycosides are absent in various solvent extracts of leaf and flowers of *P. pterocarpum*. In phytochemical evaluation studies, ethyl acetate extract of both leaf and flower extracts shows 7.42 ± 1.50 and 4.71 ± 0.07 mg of phenolic content of GAE/g. Similarly, methanolic extract of *Peltophorum pterocarpum* (DC) KHeyne showed 242 ± 0.012mg of GAE/g was reported.[23] Another report shows total phenolic content (60.53 ± 1.46 mg of GAE/g) of ethyl acetate extract from stem bark of *Peltophorum africanum*.[24] Among four extracts, ethanolic extract of flower showed maximum tannin content of 844 ± 10.38 mg TAE/g. In leaf extracts, aqueous methanolic extracts shows maximum tannin content 776.32 ± 35.01 mg TAE/g. Also, Ethyl acetate, Aqueous and ethanolic extracts showed 9.54 ± 6.97, 395.97 ± 38.62 and 487.36 ± 88.16 mg of tannic acid/g tissue respectively. The flavonoid content was found to be maximum in the leaves of ethanolic extract 1.44 ± 0.01mg quercetin equivalent (QE)/g of plant tissue. Ethyl acetate, Aqueous and aqueous methanolic extracts showed 0.33 ± 0.09mg, 0.53 ± 0.12mg and 0.28 ± 0.12mg of QE/g of plant tissue respectively. Similarly, total flavonoids content of methanolic extract from leaf of *Peltophorum pterocarpum* 72 mg QE/g was reported.[23] Another report shows total flavonoid content (18.37 ± 2.11 mg of QE/g) of ethyl acetate extract from stem bark of *Peltophorum africanum*.[24]

CONCLUSION

The present investigation demonstrates total phenolic, flavonoid and tannin content of both leaf and flower extracts of *Peltophorum pterocarpum*(DC) K Heyne. In preliminary phyto-chemical analysis of solvent extracts of *P. pterocarpum* revealed that the presence of various phyto-chemicals such as phlobatannins, terpenoids, alkaloids, saponins, tannin, reducing sugars and phenols, steroids.Among four extracts such as aqueous methanol, ethyl acetate, ethanol and aqueous extracts, ethanolic extracts of *Peltophorum pterocarpum* shows maximum total phenolic, flavonoid and tannin content. This study, thus, indicates thatthe extracts obtained from the leaves and flowers of *Peltophorum pterocarpum* (DC) K Heyne can be used for development of clinically important natural drugs.

ACKNOWLEDGEMENT

The authors would like to thank the management of Kumaraguru College of Technology, Coimbatore, TamilNadu for providing research facilities.

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

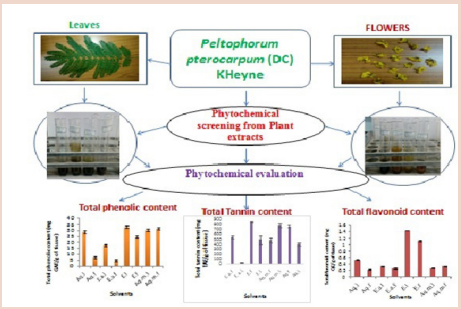
ABBREVIATION USED

Aq.l: Aqueous leaf; **Aq.f:** Aqueousflower; **E.a.l:** Ethyl acetate leaf; **E.a.f:** Ethyl acetate flower; **E.l:** Ethanol leaf; **E.f:** Ethanol flower; **Aq.m.l:** Aqueous Methanol leaf; **Aq.m.f:** Aqueous Methanol flower; **GAE:** Gallic Acid equivalent/g of tissue; **TAE:** Tannic acid equivalent mg/g tissue; **QE:** quercetin equivalent QE/g of plant tissue.

REFERENCES

1. Rasingam L, Jeeva S, Kannan D. Dental care of Andaman and Nicobar folks: medicinal plants use as tooth stick. Asian Pacific Journal of Tropical Biomedicine. 2012;2(2):S1013-6.
2. Sethuraman MG, Sulochana N, Kameswaran L. Anti-inflammatory and antibacterial activity of *Peltophorum pterocarpum* flowers. Fitoterapia. 1984;55(3): 177-9.
3. Burkill HM. The useful plants of West Tropical Africa. Royal Botanic Gardens, Kew. Second Edition. 1995;3:100-43.
4. Siri S, Wadbua P, Wongphathanakul W, Kitancharoen N, Chantaranothai P. Antibacterial and phytochemical studies of 20 Thai medicinal plants against catfish-infectious bacteria, *Aeromonas caviae*. Khon Kaen University Science Journal . 2008;36(S.1):1–10.
5. Satish S, Mohana DC, Ranhavendra MP , Raveesha KA. Antifungal activity of some plant extracts against important seed borne pathogens of *Aspergillus sp.* An International Journal of Agricultural Technology. 2007;3(1):109-19.
6. Duraipandayan V, Ayyanar M , Ignacimuthu S. Antimicrobial activity of some ethnomedicinal plants used by Paliyar tribe from Tamil Nadu, India. BMC complement. Alten Med. 2006;6(35):1472-6882.
7. Valdlapudi V , Naidu KC . *In vitro* antimicrobial screening of selected Indian medicinal plants. Int J App Biol Pharm Tech. 2010;1(2):302-7.
8. Nathan VK, Antonisamy JM, Gnanaraj WE, Subramanian KM. Phytochemical and bio-efficacy studies on methanolic flower extracts of *Peltophorum pterocarpum* (DC.) Baker ex Heyne. Asian Pacific Journal of Tropical Biomedicine. 2012;2(2):S641-5.
9. Jagessar RC, Mohamed A, Gomes G. Antibacterial and antifungal activity of leaf extracts of *Luffa operculata*,vs *Peltophorum pterocarpum* against *Candida albicans, Staphylococcus aureus* and *Escherichia coli*. Nat Sci. 2007;5(4):81-93.
10. Jain SC, Pancholi B, Jain R. *Peltophorum pterocarpum* (DC.) ex K. Heyne Flowers: Antimicrobial and antioxidant efficacies. Res J Med Plant. 2011;5(3):274-80.
11. Ling LT, Radhakrisnan AK, Subramaniam T. Assessment of antioxidant capacity and cytotoxicity of selected Malaysian plants. Molecules. 2010;15(3):2139-51.
12. Yafang S, Gan Z, Jinsong B. Total phenolic content and antioxidant capacity of rice grains with extremely small size. Afr J Agric Res. 2011;6(10):2289-93.
13. Joshi BS, Kamat VN. Identity of peltophorin with bergenin. Naturwissenschaften. 1969;56(2):89.
14. Rahman W, Ilyas M, Hameed MN. Flower pigments-Flavonoidglycoside from *Peltophorum inermis*. J Indian Chem Soc. 1969;46(3):278.
15. Rao DS. Chemical investigation of *Peltophorum inermis*. Naturwissenschaften. 1965;52(10):262.
16. Varshney IP, Dubey NK. Chemical examination of flowers of *Peltophorum inermis*. Roxb. J Indian Chem Soc. 1969;46(9):805-6.
17. Raju B, Vijaya C, Ramu A. Evalution of cardiotonic activity of *Peltophorum pterocarpum*. Int J Phytopharmacol. 2011;2(1):1-6.
18. Jain SC, Pancholi B , Jain R. Antimicrobial, free radical scavenging activities and chemical composition of *Peltophorum pterocarpum* Baker ex K. Heyne stem extract. Der Pharma Chemica. 2012;4(5):2073-79.
19. Ali MS, Azhar I, Ahmad VU, Usmanghani K. Antimicrobial screening of Mimoceous plants. Pharm Biol. 2001;39(1):43-6.
20. Bheemachari J, Ashok K, Suresh DK, Gupta VRM, Narsimhachar J. Effect of Arq Gauzaban a Unanipathy product on the isolated frog heart. Acta Pharmaceutica Turica. 2005;47(47):159-64.
21. Harborne JB. *Phytochemcial methods*. Chapman and Hall Publications: London, UK; 1998:7-8.
22. Sathishkumar T, Baskar R, Aravind M, Tilak S, Deepthi Sri, Bharathikumar VM. Simultaneous extraction, optimization and analysis of flavonoids from the flowers of *Tabernaemontana heyneana* by high performance liquid chromatography coupled to diode array detector and electrospray ionization/ mass spectrometry. ISRN Biotechnology. 2013;450948.
23. Rajeswari S, Paramjyoti S. Total phenolic, flavonoid content and hepatoprotective potentials of *Peltophorum pterocarpum* (DC) K Heyne leaf extracts. Annals of Phytomedicine. 2012;2:93-6.
24. Okeleye BI, Nongogo V, Mkwetshana NT, Ndip RN. Polyphenolic content and in vitro antioxidant evaluation of the stem bark extract of *Peltophorum africanum*-sond (Fabaceae).Afr J Tradit Complement Altern Med. 2015;12(1):1-8.

PICTORIAL ABSTRACT



SUMMARY

- Powder were prepared from both leaves and flowers of *Peltophorum pterocarpum* (DC) K Heyne for phytochemical investigation and solvent extraction.
- Plant extract were prepared by using four different solvent and solvent mixtures such as aqueous methanol, ethyl acetate, ethanol and aqueous-to extract both polar and non-polar compounds from leaves and flowers of *Peltophorum pterocarpum* (DC) K Heyne.
- Qualitative evaluation of Some phytochemical constituents from leaves and flowers of P. *pterocarpum* revealed that the presence phlobatannins, terpenoids, alkaloids, saponins, tannin, reducing sugars and phenols, steroids.
- Among four extracts such as aqueous methanol, ethyl acetate, ethanol and aqueous extracts, ethanolic extracts of *Peltophorum pterocarpum* shows maximum total phenolic, flavonoid and tannin content.
- This study, thus, indicates that the extracts obtained from the leaves and flowers of *Peltophorum pterocarpum* (DC) K Heyne can be used for development of clinically importantnatural drugs.

ABOUT AUTHORS

Mr. P. Muthukumaran: Obtained his M. Tech (Microbial Technology) in Tamil Nadu Agricultural University (TNAU), Coimbatore. Currently, he is positioned as Assistant Professor–II at Department of Biotechnology, Kumaraguru College of Technology. Currently, his doctorial research focused on the screening of Bioactive compounds from marine algae.

Dr. N. Saraswathy: Professor in Department of Biotechnology, Kumaraguru College of Technology. Has a 16 years of teaching and research experience. Her current research interest in bioactive compounds and natural polymers for wound healing, especially diabetic foot ulcer. She has two Govt. of India funded project.