International Journal of Medicine and Pharmaceutical Research

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Research Article **Open Access**

Phytochemical Analysis of the Leaf and Flower Extracts of *Peltophorum Pterocarpum*

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A B S T R A C T

Nature is our greatest medicine cabinet. It has provided mankind with numerous cures even for deadly diseases. Still there are so many cures that lie untapped in earth's ecosystem and many researches are being done in order to find the cures for many illnesses. Under natural conditions, *P. pterocarpum* is a lowland species, rarely occurring above an altitude of 100 m. It frequently grows along beaches and in mangrove forests, especially the inner margins of mangroves. The species prefers open forest conditions. *Peltophorum pterocarpum* grows in tropical climates with a dry season of 1-3 months. The tree prefers light to medium free draining alkaline soils although it tolerates clay soils. Leaves are large, 30-60 cm long, with 8-10 pairs of pinnae each bearing 10-20 pairs of oblong leaflets which are 0.8-2.5 cm long with oblique bases. Flowering occurs from March-May, although sporadic flowering may occur throughout the year (particularly in young trees), and a second flush of flowers may occur in September-November. Flowers are orange-yellow, each about 2.5 cm in diameter, fragrant, particularly at night; inflorescence is brown-tomentose and the panicles are terminal with rust-coloured buds. Fruits are 1-4 seeded pods, flat, thin, winged, 5-10 cm long, dark red when ripe, then turning black. *Peltophorum pterocarpum* has a deep root system. The specific epithet 'pterocarpum' alludes to its winged seed. The present study is undertaken to analyse the phytochemical properties of the leaf and flower extracts of *Peltophorum pterocarpum.*

Keywords: Nature, Ecosystem, *Peltophorum pterocarpum*, Phytochemical Analysis and Cure.

A R T I C L E I N F O

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Article History: Received 27 February 2015, **Accepted** 29 April 2015, **Available Online** 10 June 2015

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PAPER-QR CODE

Citation: V. Judia Harriet Sumathy. Phytochemical Analysis of the Leaf and Flower Extracts of *Peltophorum Pterocarpum. Int. J. Med. Pharm, Res*., 2015, 3(3): 1020-1025.

1. Introduction

Peltophorum pterocarpum is a very common deciduous tree grown in tropical countries and known by a variety of names such as Yellow Poinciana, Golden Flame, Copper pod, Rusty shield bearer and Yellow flamboyant (Figure 1). The plant is native to tropical southeastern Asia and northern Australia and widely grown in Sri Lanka, Thailand, Vietnam, Indonesia, Malaysia, Papua New Guinea, Philippines and the islands of the coast of Northern Territory, Australia (Joseph Joselin *et.al.*, 2014). This upright, handsome, spreading, semi evergreen tree has a rounded canopy and is capable of reaching 50 feet in height with a 35 to 50-foot spread. Form can be quite variable from tree to tree, unfortunately, eliminating this plant from the palette of many architects. With proper training and pruning in the nursery and in the landscape, a more uniform crown will develop (Orwa C *et. al.*, 2009). The dark green, delicate, feathery leaflets provide a softening effect for the tree's large size and create a welcoming, dappled shade. From May through September, the entire tree's canopy is smothered with a yellow blanket of flowers, appearing in showy, terminal panicles and exuding a delicious, grape-like perfume. These flower clusters are followed by four-inch-long seed pods which ripen to a brilliant, dark, wine-red. (Edward F. Gilman and Dennis G. Watson, 1994).

Figure 1: Tree, flowers and leaves of *Peltophorum pterocarpum*

The taxonomic classification of *Peltophorum pterocarpum* is given below in **Table 1**.

Table 1: Taxonomic Classification

Kingdom	Plantae
Sub-kingdom	Tracheobionta
Super-division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Sub-class	Rosidae
Order	Fabales
Family	Fabaceae
Sub-family	Caesalpinioidae
Genus	Peltophorum
Species	*P. pterocarpum*
Binomial Name	*Peltophorum pterocarpum* (DC.) Baker ex K. Heyne

Physicochemical Properties of Carotenoids

Solubility: Carotenoids are lipophilic with very few exceptions. They are insoluble in water but soluble in organic solvents such as acetone, alcohol, ethyl ether, chloroform and ethyl acetate. They are readily soluble in petroleum ether, hexane and toluene (**Rajeswari Satapathy and Paramjyoti Swamy, 2012)**.

Light Absorption: The conjugated double-bond system constitutes the light-absorbing chromophore that gives carotenoids their attractive color and provides the visible absorption spectrum that serves as a basis for their identification and quantification. The color enables analysts to monitor the different steps of carotenoid analysis. Loss or change of color at any time during the analysis gives an immediate indication of degradation or structural modification. The color permits visual monitoring of the separation of carotenoids in open-column chromatography, and mainly for this reason this classical technique is still a viable option for quantitative analysis of carotenoids (**Saiful Islam *et.al.*, 2011).** The ultraviolet and visible spectrum is the first diagnostic tool for the identification of carotenoids **(Figure 2).** The wavelength of maximum absorption (λ max) and the shape of the spectrum (spectral fine structure) are characteristic of the chromophore. Most carotenoids absorb maximally at three wavelengths, resulting in three-peak spectra (**Seow-Mun Hue *et.al.*, 2011)**. The greater the number of conjugated double bonds, the higher the λmax values. Thus, the most unsaturated acyclic carotenoid lycopene, with 11 conjugated double bonds, is red and absorbs at the longest wavelengths (λmax at 444, 470, and 502 nm). At least 7 conjugated double bonds are needed for a carotenoid to have perceptible color. Thus, ζ- carotene is light yellow **(Delia B. Rodriguez-Amaya, 2001)**. Some of the structures of the typical carotenoids present in higher plants are given below in **Figure 2.**

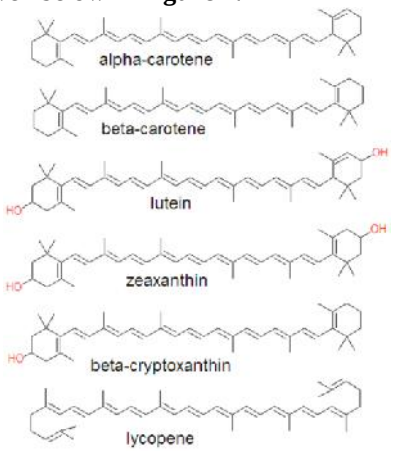

Figure 2: Structure of some typical carotenoids present in higher plants

2. Materials and Methods

Phytochemical Analysis

Preparation of Extracts

The leaves and the flowers of *Peltophorum pterocarpum* were collected and dried in shade for over two weeks. The dried leaves and flowers were ground into powder. 5gm of the dried leaves and flower powder was weighed and immersed in 50 ml of the solvents – Chloroform, Ethanol and Ethylacetate for 48 hours. After 48 hours, the extracts were filtered and the filterate is used for further phytochemical analysis.

Phytochemical Tests

Preparation of Reagents

1) 20% Ethyl Alcohol - 20ml of Ethyl alcohol in 80ml of distilled water
2) 4% Sodium hydroxide – 4ml of NaOH in 96ml of distilled water
3) 1% Copper sulphate – 1g of CuSO4 in 100ml of distilled water
4) 1% Ninhydrin reagent – 1g of Ninhydrin in 100ml of distilled water
5) 5% Ferric chloride – 5g Ferric chloride in 100ml of distilled water
6) Hager's Reagent – 1g of Picric acid in 100ml of distilled water
7) 1% Lead acetate solution – 1g of Lead acetate in 100ml of distilled water
8) Mayer's Reagent – 1.358g of Mercuric chloride was dissolved in 60ml of distilled water and 5g of potassium iodide was dissolved in 10ml of distilled water. Both the solutions are mixed well and used.

Test for Carbohydrates (Brian and Turner -1975)

1. **Molisch Test**
   To about 2 ml of the extracts two drops of α-naphthol (20% in ethyl alcohol) was added. Then about 1 ml of concentrated Sulphuric acid was added along the sides of the test tube. Reddish violet ring at the junction of the two layers appears in the presence of carbohydrates.
2. **Reduction of Fehling's solution**
   10 ml of Fehling's solution (CuSO4 in alkaline solution) was added to the concentrated extracts and heated on a steam bath. Brick red precipitate indicates the presence of carbohydrates.
3. **Test for Proteins: (Umesh *et. al.*, 2010)**
   Biuret Test
4. To 3 ml of the extracts 4% NaOH and few drops of 1% CuSO4 solution are added. Appearance of pink or violet colour indicated the presence of proteins.
5. **Ninhydrin Test**
   To 1 ml of the extract 1% Ninhydrin reagent was added and heated on a steam bath. Appearance of violet colour indicates the presence of proteins.
6. **Test for Glycosides: (Umesh *et. al.*, 2010)**
   Keller-Killani Test
   1 ml of glacial acetic acid and 1 ml of concentrated sulphuric acid are added to 1 ml of the extract. A reddish brown colour is formed at the junction of two layers and the upper layer turns bluish green indicating the presence of glycosides.
7. **Test for Tannins: (Culki I. 1994)**
   2 ml of 5% ferric chloride is added to 1 ml of the extract. A dark blue or green black colour appears which indicates the presence of tannins.
8. **Test for Alkaloids: (Culki I. 1994)**
   a. To 2ml of the extract 2-3 drops of Hager's reagent (Picric acid) is added. A yellow precipitate or yellow solution indicates the presence of alkaloids.
   b. To 2ml of the extract 2 ml of concentrated hydrochloric acid and few drops of Mayer's reagent are added. A green or white precipitate indicates the presence of alkaloids.
9. **Test for Flavonoid**
   To 2 ml of the extract 1 ml of lead acetate solution is added. Appearance of white precipitate or yellow precipitate indicates the presence of flavonoids.
10. **Test for Terpenoids**
    To 2 ml of the extract, 5ml of chloroform and a few drops of concentrated sulphuric acid is added. A reddish brown colouration formed in the interface shows positive results for the presence of terpenoids.
11. **Test for Saponins**
    To a few ml of the crude extract, 5 ml of distilled water is added and shaken vigorously. Formation of stable foam indicates the presence of saponins.
12. **Test for Resins**
    Acetone Water Test:
    To a few ml of the extract, acetone and a small amount of water was added and shaken well. Appearance of turbidity indicates the presence of resins.

3. Results and Discussion

Phytochemical Analysis

Phytochemical Analysis

The following results were obtained for the phytochemical analysis of the Leaves and Flower extract of *Peltophorum pterocarpum.*

Test for Carbohydrates

Molisch Test

Both the leaves and flower (three solvent) extracts showed the absence of carbohydrates in this test.

Reduction of Fehling's solution

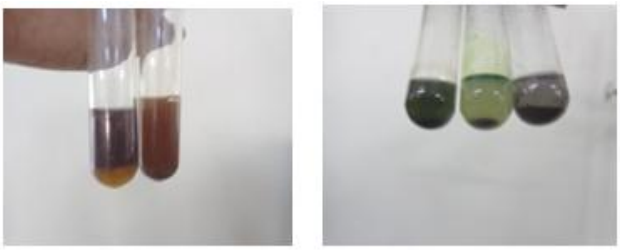

Figure 3: Reduction of Fehling's solution by the flower and leaf extracts

The ethanolic and chloroform flower extracts of all the three solvent extracts of the leaves reduced the Fehling's solution to brick red precipitate thus confirming the presence of carbohydrates (**Figure 3**).

Test for proteins

All the three solvent extracts of the leaves and flowers showed the absence of proteins in both the Biuret test and Ninhydrin test.

Test for Glycosides

Keller Killani Test

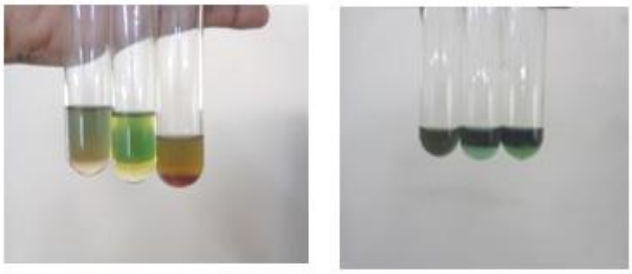

Figure 4: Glycosides test for flower and leaf extracts

All the three solvent extracts of the leaves and flowers showed the presence of glycosides. A reddish brown colour is formed at the junction of two layers and the upper layer turns bluish green indicates the presence of glycosides (**Figure 4**).

Test for Tannins

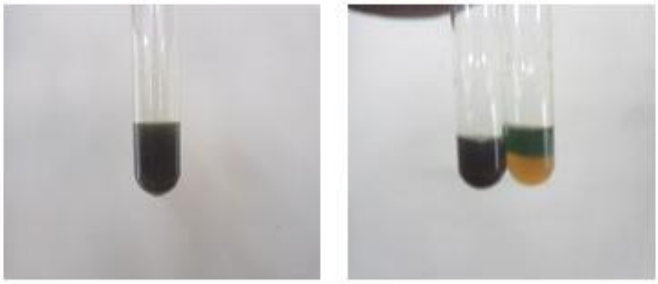

Figure 5: Tannins Test for flower and leaf extracts

The ethanolic flower extract and the ethanol and ethyl acetate leaves extract indicated the presence of Tannins by forming a green black colour (**Figure 5).**

Test for Alkaloids

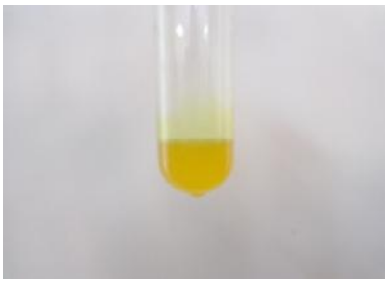

Figure 6: Alkaloids test for Flower extract

The ethanolic flower extract showed the presence of alkaloids by forming an yellow colouration with Hager's reagent (Picric acid) (**Figure 6)**. The alkaloids were absent in all the three solvent extracts of leaves when tested with Hager's reagent.

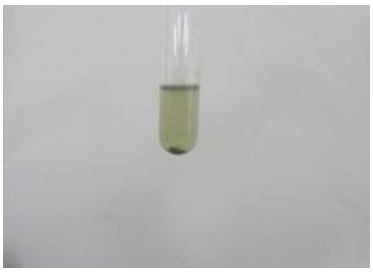

Figure 7: Alkaloids test for Leaf Extract

The ethanolic leaf extract showed the presence of alkaloids by forming a green precipitate (**Figure 7)** with Mayer's reagent while the flower extracts showed the absence of alkaloids**.**

Test for flavonoids

Figure 8: Flavonoids Test for Leaf Extracts

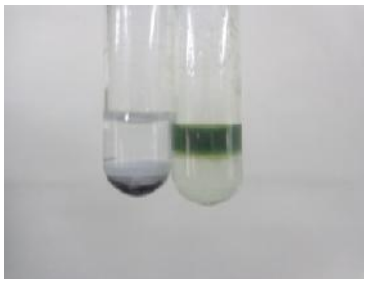

Figure 9: Flavonoids Test for Flower Extracts

The chloroform and ethyl acetate flower and leaf extracts showed the presence of the flavonoids by forming a white precipitate or yellow precipitate with lead acetate (**Figures 8 & 9).**

Test for Terpenoids

Figure 10: Terpenoids Test for Flower and Leaf Extracts

The ethanolic flower and leaf extracts showed the presence of the terpenoids by forming a reddish brown coloration with chloroform and sulphuric acid (**Figure 10).**

Test for Saponins

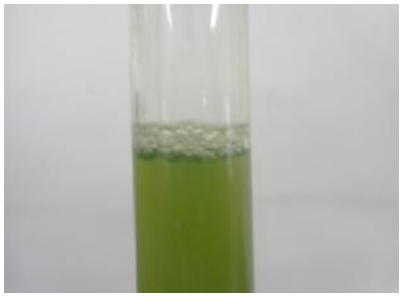

Figure 11: Saponins Test for Leaf Extracts

The ethanolic leaf extract when shaken with distilled water formed stable foam indicating the presence of saponins while the leaf extract did not show any foam formation with distilled water (**Figure 11).**

Test for Resins

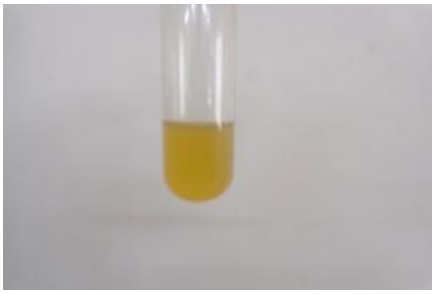

Figure 12: Resins test for Flower Extract

The ethanolic flower extract showed the presence of turbidity with acetone and water thus confirming the presence of resins. The leaf extracts did not show any presence of resins with acetone and water (**Figure 12).**

Table 2: Phytochemicals present in the Leaf extracts

S.No	Phytochemicals	Ethanol extract	Chloroform extract	Ethyl acetate extract
1.	Carbohydrates	+	-	-
2.	Proteins	-	-	-
3.	Glycosides	+	+	+
4.	Tannins	+	-	+
5.	Alkaloids	+	-	-
6.	Flavonoids	+	+	-
7.	Terpenoids	+	-	-
8.	Saponins	+	-	-
9.	Resins	-	-	-

Table 3: Phytochemicals present in the Flower extracts

S.No	Phytochemicals	Ethanol extract	Chloroform extract	Ethyl acetate extract
1.	Carbohydrates	+	+	+
2.	Proteins	-	-	-
3.	Glycosides	+	+	+
4.	Tannins	+	-	-
5.	Alkaloids	+	-	-
6.	Flavonoids	+	+	-
7.	Terpenoids	+	-	-
8.	Saponins	-	-	-
9.	Resins	+	-	-

Preliminary phytochemical screening of the leaf extracts showed the presence of carbohydrates, glycosides, tannins, alkaloids, flavonoids, terpenoids and saponins in the ethanol extract (**Table 2)**. The chloroform extracts showed the presence of glycosides and flavonoids while the ethyl acetate extracts showed the presence of glycosides and tannins. Proteins were found to be absent in all the three solvent extracts. The ethanol extract of the leaves showed the presence of maximum phytochemicals that have been investigated**.** Preliminary phytochemical screening of the flower extracts showed the presence of carbohydrates, glycosides, tannins, alkaloids, flavonoids, terpenoids and resins in the ethanol extract (**Table 3**). The chloroform extracts showed the presence of carbohydrates, glycosides and flavonoids while the ethyl acetate extracts showed the presence of carbohydrates and glycosides. Here also proteins were found to be absent in all the three solvent extracts. Phytochemicals play an important role in a plant's metabolic activities. Based on the phytochemicals present, the plant could exhibit various activities such as antimicrobial, antioxidant and anticancer activities. Here, the ethanol extracts showed the presence of maximum phytochemicals and hence the ethanolic leaf and flower extracts can be used to determine antioxidant, antimicrobial and anticancer activities.

4. Conclusion

The solvent (chloroform, ethanol and ethylacetate) extracts of leaves and flowers of *Peltophorum pterocarpum* were subjected to phytochemical analysis. The ethanol extracts showed the presence of carbohydrates, glycosides, tannins, alkaloids, flavonoids, terpenoids and resins whereas the chloroform extracts showed the presence of carbohydrates, glycosides and flavonoids. Ethyl acetate extracts showed the presence of carbohydrates and glycosides. Proteins were found to be absent in all the three solvent extracts. Apart from this Carotenoids and some of their metabolites are suggested to play a protective role in a number of ROS-mediated disorders, such as, *i.e.*, cardiovascular diseases, several types of cancer or neurological, as well as photosensitive or eye-related disorders. Carotenoids are also suggested to participate in: (i) the stimulation of the immune system; (ii) the modulation of intracellular signaling pathways (gap junction communication); (iii) the regulation of the cell cycle and apoptosis; (iv) the modulation of growth factors; (v) cell differentiation; and (vi) the modulation of various types of receptors or adhesion molecules and many other physiologically significant processes. Future studies can be undertaken to study the multi-faceted medicinal value of these carotenoids pigments.

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