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Research Article

Phytochemical screening of selected medicinal plants of the family Lythraceae

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Abstract

To investigate the secondary metabolites present in the leaves of the family Lythraceae (*Lagerstroemia microcarpa* Wt., *Lagerstroemia reginae* Roxb., *Lawsonia inermis* L., *Punica granatum* L.). The samples were extracted using solvents like acetone, chloroform, ethanol, petroleum ether and water. These mixtures were shaken at room temperature for 24 h. After incubation, the extracts were filtered using Whatman No.1 filter paper, collected and stored at 4°C. The extracts were concentrated using vacuum evaporator and dried at 60°C. Preliminary phytochemical screening was performed by standard methods. The phytochemical screening revealed the presence of alkaloids, carbohydrates, flavonoids, phytosterols, proteins, steroids, terpenoids, phenols, saponins, quinones, coumarins and glycosides. The findings of the study concluded that the leaf extracts have potential bioactive substances that may be used to formulate new and most potent antimicrobial drugs to overcome the problem of disease resistance.

INTRODUCTION

Medicinal plants play a major role in meeting the medical and health needs of about 70% of populations in developed and developing countries, which serve as an important resource for the treatment of various maladies and illnesses (Ngari *et al*., 2010). In developing countries, there is an increasing attempt to incorporate the traditional medicines, especially herbal preparations in the local healthcare systems and modernized people are increasingly turning to herbal medicine (Njoroge and Bussmann, 2007). Globally, about 85% of the traditional medicines used by different ethnic groups inhabiting various terrains for primary healthcare are derived from plants, especially in India; medicinal plants are widely used by all sections of the population with an estimated 7500 species of plants used by several ethnic communities (Farnsworth, 1988). The medicinal importance of a plant is due to the presence of some special substances like alkaloids, glycosides, resins, volatile oils, gums and tannins etc. The active principles usually remain concentrated in the storage organs of the plants (Himesh *et al*., 2011).

Lythraceae, the loosestrife family, with about 31 genera and 620 species of mostly perennial herbs, shrubs or trees is widely distributed in tropics but ranging into temperate climate regions (Mabberley, 2008; Walter *et al*., 2008). Many of the wild and cultivated species of lythraceae are known to have a medicinal importance (Shivrajan and Bhalchandra, 1994).

Lagerstroemia microcarpa Wt. is a large deciduous tree, to 30m high, it is a very common tree in west coast of the Indian peninsular and also commonly found in Western Ghats around Mumbai, Mysore, and Nilgiri hills. It is commonly known as "Nude Lady of the Forest" for its soft and smooth bark resembling the thigh of women and locally known as 'Venthekku'.

Lagerstroemia reginae Roxb. is a medium sized deciduous tropical flowering tree with a rounded crown. It is distributed in tropical Himalaya, Assam, Bengal, Ceylon, Java, Eastern and Western Ghats up to 2000 feet (Anonymous, 1962). It is known as 'Pride of India', 'Queen's flowers' and 'Queen Crape Myrtle'. It is also widely cultivated as an ornamental plant in tropical and subtropical areas for its beautiful flowers. Leaves are used as purgative, diuretic and deobstruent. A decoction of the leaves, also of dried fruits, is used like tea for diabetes mellitus in Philippines (Kiritikar and Basu, 1933). The plant contains triterpenoids, colocolic acid and maslinic acid. Leaves contain lageracetal and sitosterol. Ellagitannins have been isolated from fruits and leaves (Khare, 2007). The plant is used for abdominal pains, mouth ulcers; seed is narcotic; bark decoction used for diarrhea and abdominal pain; fruit is used for aphthae of the mouth; roots are considered astringent, stimulant, febrifuge and used for stomach ailments (Diadelis *et al*., 2005).

Lawsonia inermis L. is a tall shrub, commonly known as 'Henna' or 'Mehndi' and widely distributed in tropical and subtropical areas (Muhammad and Muhammad, 2005). Main chemical constituents of henna are Lawsone (2-hydroxynaphthoquinone), mucilage, mannite, gallic acid, tannic acid, phenolic compounds, terpenoids, sterols, aliphatic constituents, xanthones, coumarins, flavonoids and essential oil present in various parts (Al-Rubiay *et al*., 2008). This plant (leaves, flowers, seeds, stem bark and roots) are used in traditional medicine to treat variety of ailments like rheumatoid arthritis, headache, ulcers, diarrhea, leprosy, fever, leucorrhea, diabetes, cardiac diseases, oedema, bronchitis, menstrual disorder, rheumatism, hemorrhoids, jaundice, pain, spleen enlargement, dysentery, skin problem and pediculosis (Warrier *et al*., 1994; Bhuvaneshwari *et al*., 2002; Cuong *et al*., 2009; Rahmoun *et al*., 2010) and used as a cosmetic agent for dyeing hair, nails and skin (Hanna *et al*., 1988).

Punica granatum L. is an evergreen or deciduous tree, commonly known as 'Pomegranate'. It is distributed in throughout the world, now it is widely cultivated in Mediterranean, Himalayas, Northern India to Iran and more arid regions of Southeast Asia, the East Indies and tropical Africa; it is valued for its delicious edible fruit (Naqvi *et al*., 1991; Oukablie, 2004; Bellakhdar, 2006). This plant shows the presence of phytoconstituents such as punicalin, punicalagin, fatty acids, sterols, triterpenoids, anthocyanins, flavonoids, alkaloids, glycosides, resins, volatile oils, fibres, proteins, polyphenolic compounds, gums and tannins (Schubert *et al*., 1999; Saxena and Vikram, 2004; Lansky and Newmann, 2007). The wide range of therapeutic properties of pomegranate are used to treat and prevention of cancer, cardiovascular disease, diabetes, dental conditions and protection from UV radiation, Alzheimer's disease, male infertility, arthritis and obesity (Dipak *et al*., 2012).

So far there are only a few studies regarding phytochemistry, hence the present study was aimed to determine the phytoconstituents present in the Lythraceae family members.

MATERIALS AND METHODS

The fresh, mature healthy leaves of *Lagerstroemia microcarpa* Wt., *Lagerstroemia reginae* Roxb., *Lawsonia inermis* L., *Punica granatum* L. were collected from Nagercoil and its surrounding areas. The plant samples were shade dried and ground into fine powder with the help of mixer grinder. About 50g of powdered material was extracted in Soxhlet apparatus with 200 ml of each of the following solvents; aqueous, petroleum ether, acetone, ethanol and chloroform. The extracts obtained with each solvent were filtered through Whatman filter paper No. 1 and the filtrate was used for phytochemical analysis as per the standard prescribed methods (Harborne, 1998).

RESULTS AND DISCUSSION

Qualitative phytochemical screening was done in various leaf extracts of *L. reginae*, *L. microcarpa*, *L. inermis* and *P. granatum*. The phytoconstituents present were shown in Table 1. Out of the twenty tested extracts, eighteen extracts showed the presence of phytosterols, seventeen extracts showed the presence of steroids, fifteen extracts showed the presence of terpenoids, fourteen extracts showed the presence of proteins, twelve extracts showed the presence of phenols, ten extracts showed the presence of quinones, carbohydrates, flavonoids, coumarins, followed by

saponins and alkaloids in six extracts and glycosides were noticed only in two extracts. The value of medicinal plants lies in some chemical substances that produce a definite physiological action on the human body and the most important phytochemicals are alkaloids, flavonoids, tannins and phenolic compounds (Hill, 1952). The Medicinal plants have potent phytochemical components which are important source of antibiotic compounds and are responsible for the therapeutic properties (Jeeva *et al*., 2011; Jeeva and Johnson, 2012; Florence *et al*., 2012 & 2014**;** Joselin *et al*., 2012 & 2013; Sainkhediya and Ray, 2012; Sumathi and Uthayakumari, 2014).

In the present study, the leaf extracts of *Punica granatum* detected all the tested phytochemicals including alkaloids, carbohydrates, coumarins, flavonoids, glycosides, phenols, phytosterols, proteins, saponins, quinones, steroids and terpenoids. (Bhandary, 2012) reported that aqueous, chloroform and ethanol extracts of *P. granatum* peel showed the presence of triterpenoids, steroids, glycosides, flavonoids, tannins, carbohydrates and vitamin C; fruit extracts contains alkaloids, saponins, triterpenoids, steroids, glycosides, flavonoids, tannins, carbohydrates and vitamin C; extracts prepared from the seeds contains triterpenoids, alkaloids, steroids, glycosides, flavonoids, tannins, carbohydrates and vitamin C. In a previous study aqueous-ethanol extract of peel is diminished the blood sugar level and also induce the hyperlipidemia due to the presence of polyphenolic compounds (Cheng, 2005) and also provide protective effect against carbon tetrachloride and toxicity (Singh, 2002**;** Qnais, 2007) and methanolic extract of the *P. granatum* fruit peel is highly nutritive and contains the major chemical components such as punicalin, punicalagin, punicic acid and flavonoids like flavonols, flavones, kaempferol, luteolin, quercetin and high content of phenolic acids such as caffeic acid, fumaric acids, chlorogenic acid and P-coumaric acid (Akbarpour *et al*., 2009**;** Usha, 2013); hydroxy benzoic acids such as gallagic acid and EA glycosides (Amakura, 2000) and also gallic acid, ellagitannins, catechin and ellagic acid (Nasr, 1996; Murthy *et al*., 2004). These ellagic acids exhibits powerful anticarcinogenic and antioxidant properties due to the presence of tannins (Shwartz *et al*., 2009), anthocyanidines such as cyanidin, pelergonidin and delphinidin (Noda, 2002) and also have high antibacterial activity against *E. coli* due to the presence of alkaloids, flavonoids and tannins (Growther, 2012).

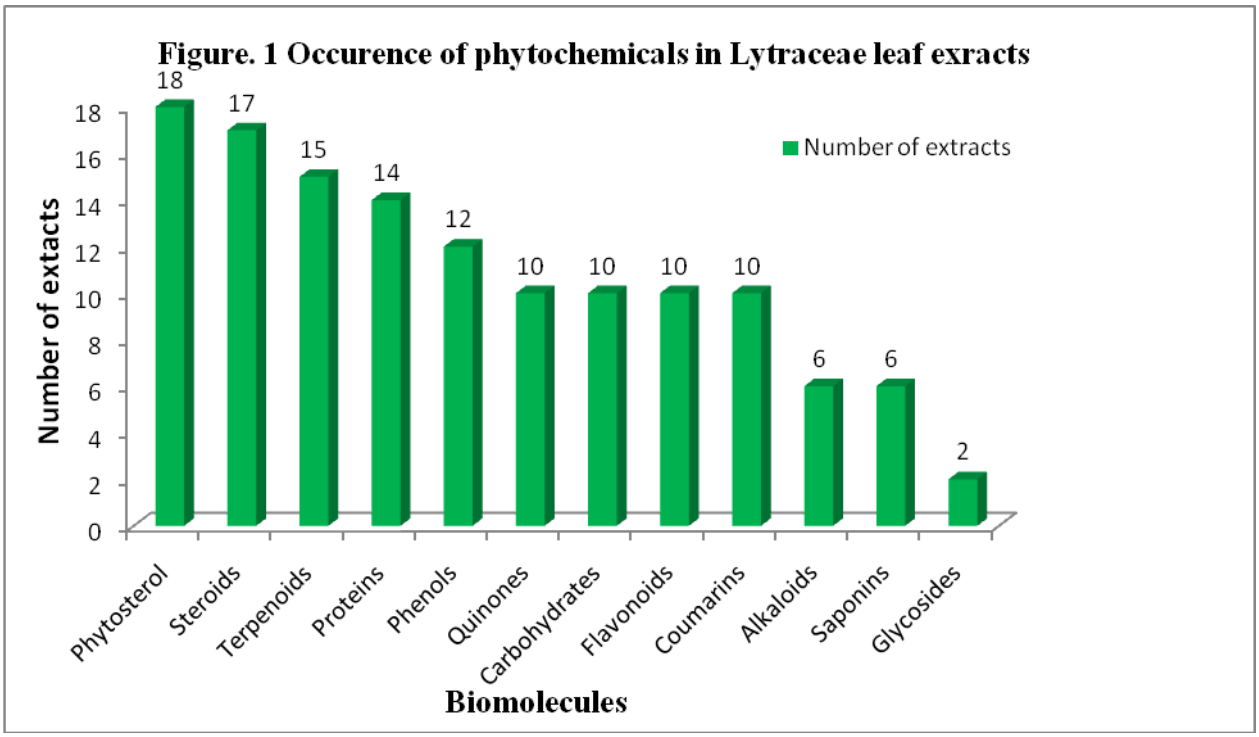

Figure. 1 Occurence of phytochemicals in Lytraceae leaf exracts

This plant is effective in scavenging the free radicals due to the presence of anthocyanins, anthocyanidins, flavonoids and polyphenols (Kiran, 2013; Prasad *et al*., 2012) and highest antioxidant activity due to the presence of tannins (Shwartz *et al*., 2009) and also act as ecofriendly waste because of its numerous uses such as reducing agent in making silver nanoparticles (Middha *et al*., 2013).
It also has ethnomedical properties such as anti-hyperglycemic (Middha *et al*., 2012), hepatoprotective effects (Murthy *et al*., 2004), antidiarrhoeal agent (Das, 1999) and also used in the treatment and prevention of cancer (Hong, 2008**;** Dikmen, 2011), cardiovascular disease (Jurenka, 2008), diabetes (Al-Mustafa and Al-Thunibat, 2008), infant brain ischemia, alzheimer's disease, Parkinson's disease, AIDS (Middha *et al*., 2011**;** Singh *et al*., 2012), dental conditions (Viuda-Martos *et al*., 2010), erectile dysfunction, protection from ultraviolet radiation, male infertility, arthritis, obesity (Kanatt *et al*., 2010) and dermal wounds (Hayouni *et al*., 2011) and also used as cattle feed and extraction of natural dyes (Shabtay *et al*., 2008).

The crude leaf extracts of *Lawsonia inermis* contains the phytoconstituents such as alkaloids, carbohydrates, coumarins, phenols, phytosterols, proteins, quinones, steroids and terpenoids. The aqueous, chloroform, methanol and acetone exracts of *L. inermis* had cardioglycosides, terpenoids, carbohydrates, phenols, quinones, tannins and proteins (Gull *et al*., 2013). The phytochemical constituents of *L. inermis* exhibit antimicrobial activity against both gram positive (*S. aureus*, *B. subtilis*, and *S. epidermidis*) and gram negative (*E. coli*, *S. typhi*, *Klebsiella* sp. and *Shigella* sp.) bacteria due to the presence of quinones (Hussain *et al*., 2011; Habbal *et al*., 2005). Similar studies were conducted by (Arun, 2010) on the methanolic extract of the *L. inermis* which showed active results against *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, *Proteus mirabilis* due to the presence of alkaloids, flavonoids, tannins and quinones. Aqueous, petroleum ether, chloroform, ethyl-acetate and methanol extract of the *L. inermis* leaves shows the phytoconstituents such as alkaloids, carbohydrates, flavonoids, glycosides, resins, tannins, saponins and sterols which showed antibacterial activities against *Streptococcus pneumoniae*, *Streptococcus pyogenes* and *Shigella dysenteriae* (Kawo and Kwa, 2011). (Saadabi, 2007) mentioned that methanol and chloroform extract of *L. inermis* leaves revealed the presence of mannite, tannic acid, gallic acid, naphthaquinone, crysophanic acid, anthraquinones, mucilage, sterols, terpenoids and cyanogenic glycosides and also have antibacterial activity against *S. aeruginosa*, *P. aeruginosa*, *B. subtilis* and *E. coli*. It was reported that aqueous, petroleum ether, benzene, chloroform, methanol and ethanol extracts of the plant showed high antifungal activity against *Aspergillus flavus* which isolated from sorghum, maize and paddy seed samples (Dixit *et al*., 1980). Henna used as an astringent and antihemorragic agent and is also known for its hypotensive, cardio inhibitory and sedative effects (Rahmoun *et al*., 2010), hypoglycemic (Syamsudin and Winarno, 2008), immunostimulant (Mikhaeil *et al*., 2004), hepatoprotective (Chaudary *et al*., 2012), anti-inflammatory (Singh *et al*., 1982), tuberculostatic (Sharma, 1990), anti-cancer and antioxidant properties (Kamal and Jawaid, 2010), antibacterial (Aliyu, 2006), antifungal, antiamoebiasis, (Khattak *et al*., 1985), antidiarrhoel, antipyretic, analgesic effects (Ali *et al*., 1995) diuretic, emmanagogue and abortifacient prophetically and non-toxic (Lemordant and Foresteier, 1983).

Lagerstroemia reginae leaf extracts was subjected to preliminary phytochemical screening to screen secondary metabolites namely alkaloids, carbohydrates, coumarins, flavonoids, glycosides, phenols, phytosterols, proteins, quinones, saponins, sterols, terpenoids. Similar studies conducted by (Meera, 2009) on the ethylacetate, butanol and water extract which showed bioconstituents such as aminoacids, tannins, phytosterols and cardioglycosides and also have antibacterial, antiviral, antioxidant and anti-inflammatory activity. The plant contains triterpenoids, colocolic acid and maslinic acid; leaves contain lageracetal and sitosterol; fruits and leaves contain ellagitannins (Khare, 2007) and exhibit hypoglycemic activity (Vivek *et al*., 2012). The primary active chemical ingredient of the leaf extract is corosolic acid and is known potent glucophage, helpful in decreasing blood sugar levels (Principe and Jose, 2002). Phytochemical screening yielded phenolic compounds, flavonoids, saponins, tannins such as corosolic acid, ellagitannin, lagerstroemin, gallotannins, penta-O-galloyl-glucopyranase (Bai *et al*., 2008). (George *et al*., 2010) proved that methanolic extract of the leaves of *Lagerstroemia reginae* revealed the presence of alkaloids, saponins, flavonoids, glycosides, tannins and terpenoids as well as the methanolic extract of

Lagerstroemia speciosa leaves showed the presence of anthraquinones, flavonoids, saponins and tannins and this extract exhibited high antibacterial activity against *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* due to the presence of detected metabolites and also anticarcinogenic activity (Laruan *et al*., 2013). The leaf extract of this plant is reported as nephroprotective agent (Priya *et al*., 2007); hepatoprotective, free radical scavenging activity (Priya *et al*., 2009) and diuretic activity (Kalidas *et al*., 2008).

Leaf extracts of *Lagerstroemia microcarpa* leaf extracts showed the presence of phytochemical constituents such as terpenoids, steroids, phytosterols, flavonoids, carbohydrates, proteins and saponins. There are no previous preliminary phytochemical and other reports in this plant.

Conclusion

The results of phytochemical screening of the leaves of *L. reginae*, *L. microcarpa*, *L. inermis* and *P. granatum* showed phytochemical constituents such as alkaloids, carbohydrates, flavonoids, saponins, coumarins, quinones, phytosterols, proteins, glycosides, steroids, terpenoids and phenols in varied compositions in various extracts which has great medicinal and pharmacological properties. Furthermore evaluation is needed to isolate the bioactive substances which can be used for welfare of the mankind.

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Table 1. Preliminary phytochemical screening of leaf extracts of selected Lythraceae members

Lagerstroemia reginae	**Phytochemical compounds**											
	Alkaloids	**Carbohydrates**	**Coumarins**	**Flavonoids**	**Glycosides**	**Phenols**	**Phytosterols**	**Proteins**	**Quinones**	**Saponins**	**Sterols**	**Terpenoids**
Aqueous	-	+	+++	+++	-	+++	+++	+	++	-	+	-
Petroleum ether	-	-	-	-	-	-	+++	-	-	+	-	-
Chloroform	-	+++	-	-	+	-	+++	-	+	-	+++	+
Ethanol	+	+	+++	+++	-	+++	+++	++	++	+++	+++	++
Acetone	+++	+	++	+++	-	+++	+++	-	+++	++	+++	+++
Lawsonia inermis												
Aqueous	+++	++	+	-	-	+++	+++	+	+++	-	+++	-
Petroleum ether	-	-	-	-	-	-	+++	++	-	-	+	-
Chloroform	-	+++	++	-	-	+++	+++	+	++	-	++	+++
Ethanol	+	++	+	-	-	+++	+++	+	+++	-	+++	+++
Acetone	-	++	+	-	-	+++	+++	+	+++	-	+++	+++
Lagerstroemia microcarpa												
Aqueous	-	-	-	.	-	-	++	++	-	-	+++	+++
Petroleum ether	-	-	-	-	-	-	-	-	-	-	++	+
Chloroform	-	+++	+	-	-	-	-	-	-	-	-	+
Ethanol	-	-	-	++	-	-	++	+	-	-	+	+
Acetone	-	-	-	+++	-	-	+++	-	-	++	+	+
Punica granatum												
Aqueous	-	-	++	+++	-	+++	++	+	+++	-	+	+
Petroleum ether	-	-	+	+++	+	+	+++	+	-	-	-	-
Chloroform	-	+	-	++	-	++	+++	+	+++	-	+++	++
Ethanol	++	-	-	+++	-	+++	+++	+	-	++	+++	+++
Acetone	+	-	-	+++	-	+++	++	+	-	+++	+++	+++

Abbreviations: (-) Absent; (+) Low; (++) Average; (+++) High

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