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SCREENING OF PHYTOCHEMICAL CONSTITUENTS FROM CERTAIN FLOWER EXTRACTS

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ABSTRACT

Extracts were prepared by adding 50 g of fresh flowers of *Dillenia pentagyna* Roxb., *Garcinia gummigutta* L., *Hamelia patens* Jacq., *Hyptis suaveolens* (L.) Poit., *Ipomea tricolor* Cav., *Ixora coccinea* L., *Ochna obtusata* DC., and *Pentas lanceolata* (Forssk) Deflers to 200 ml of aqueous, petroleum ether, chloroform, ethanol and acetone solvents; the constituents 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 carried out using standard methods. The presence or absence of the phyto-constituents depended upon the solvent used and physiological property of the flowers. From the present study it can be concluded that the constituents present in various extracts may be responsible for the various activities of the plant based drugs.

Key words: Phytoconstituents, Phytochemical Screening, Flower Extracts, Solvents.

INTRODUCTION

Plants are the gifts of nature and have been utilized by human beings for basic preventive and curative healthcare since time immemorial. Secondary metabolites derived from plant extracts have been reported scientifically for biological activities and can also protect humans against infectious diseases [1-3]. Biologically active ingredients include alkaloids, flavonoids, steroids, glycosides, terpenes and tannins [4]. These phytoconstituents can be used for the treatment of various diseases due to wide range of biological activity [5,6]. To promote the proper use and to determine their potential as sources for new drugs, it is essential to study the medicinal plants [7]. In India almost 95% of the prescriptions were plant based in the traditional systems of Unani, Ayurveda, Siddha and Homeopathy [8]. The WHO estimated that about 80% of population in developing countries relies on traditional medicines for their primary health care needs [9].

Dillenia pentagyna Roxb. (Dilleniaceae) is a tree used in traditional medicine for the treatment of tumor, asthma, stomachache, wounds and scabies [10]. The ethanol extract of stem bark of *D. pentagyna possessed* bioconstituents such as alkaloids, flavonoids, tannins, saponins, iridoids and proanthocyanidines [11,12].

Garcinia gummigutta L. (Clusiaceae) is a fruit tree mainly planted in homesteads for its fruits that are used in food preparations. The main component of the fruits is hydroxyl citric acid and is used in anti obesity drugs [13] and also possesss medicinal properties [14]. Other chemical components of the fruit include tartaric acid, camogin, glucinol, euxanthone, reducing sugars and fats. The fruit extracts are used for various treatments such as astringent, demulcent, rheumatism, bowel complaints and purgative [15].

Hamelia patens Jacq. (Rubiaceae) is a perennial shrub, planted as an ornamental. It is commonly called 'Fire bush' or 'Humming bird bush'. Fire bush is used in herbal medicine to treat athletes' foot, skin lesions and rash, insect bites, nervous shock, inflammation, rheumatism, headache, asthma and dysentery [16]. Phytoconstituents like alkaloids and flavonoids are rich in the tissues. The bark contains significant amounts of tannins, also contains 17% crude proteins and has an *in vitro* digestability of 61% [17]. Other active components include maruquine, pteropodine, isopteropodine, palmirine, rumberine, seneciophylline and stigmast-4-ene-3, 6-dione [18].

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Hyptis suaveolens (L.) Poit (Lamiaceae) commonly known as 'Wilayati tulsi' is an ethnobotanically important medicinal plant used in traditional medicine to treat various diseases. Leaves and twigs were used as stimulant, carminative, antisudorific baths, galactgogue, antispasmodic, antirheumatic, anti-inflammatory and antifertility agents [19] and also applied as an antiseptic in burns, wounds, various skin complaints and cure for parasitic cutaneous diseases [20]. The root decoction is highly valued as appetizer and is reported to contain ursolic acid, a natural HIV- integrase inhibitor [21]. Tribal people continue to use the plant in the treatment of wound. The leaves also serve as the source of many bioactive components which are used as anti inflammatory agents[22].

Ipomea tricolor Cav. (Convolvulaceae) is an annual or perennial climber commonly known as 'Heavenly Blue'. Numerous cultivars of *I. tricolor* with different flower colors have been selected for use as ornamental plants and the cultivar 'Heavenly Blue' has gained the Royal Horticultural Society's Award of Garden Merit [23]. The seeds, vines, flowers and leaves contain ergoline alkaloids and the seeds also contain glycosides, which may cause nausea if consumed [24].

Ixora coccinea L. (Rubiaceae) is a shrub known as 'Jungle of geranium'. Flowers yield cyanidins, flaconboides, leucocyanidin, rutin and quercetin [25, 26]. The flowers are used to cure dysentery, leucorrhoea, dysmenorrhoea, hemoptysis and catarrhal bronchitis, gonorrhea, bronchitis, sores, chronic ulcer, scabies, cholera and dermatitis [27]. Leaves yield flavonols, kaemferol, quercetin, proanthrocyanidines, phenolic acids and ferulic acids. The leaf and stem are used to treat sprains, eczema, diarrhea, boils and contusions. Decoction of leaf is employed as a lotion for eye troubles and also used as sedative. Roots contain aromatic acrid oil, tannins, fatty acids. Roots and flowers are used in diarrhea, dysentery, dysmenorrhea, gonorrhea and fever and its decoction used for nausea, hiccups and anorexia, sores and chronic ulcers and it possess astringent and antiseptic properties [28]. Decoction prepared from the plant is a good blood purifier and beneficial to skin infections like itches, scabies, boils etc [29, 30].

Ochna obtusata DC. (Ochnaceae) is a small tree up to 8 m tall. The family is characterized by the presence of secondary metabolites like flavonoids [31, 32], terpenoids [33, 34] and it is extensively used in Indian traditional medicine for the treatment of epilepsy, menstrual complaints, lumbago, asthma, ulcers, and as an antidote to snake bites [35,19]. Several studies conducted on *Ochna* species revealed the presence of glycosides, saponins, steroids, flavones and fattyacids [36]. The leaves and roots of *O. obtusata* is used for ulcer, asthma and bronchitis [37] and also possess antiulcerogenic activity [38].

Pentas lanceolata (Forssk) Deflers (Rubiaceae) commonly known as 'Egyptian Star cluster', is an herbaceous perennial flowering plant in madder family. Anthraquinones isolated from the methanol root extracts of the *P. lanceolata* showed antiplasmodial activity [39] and these extracts were used to treat range of diseases [40].
Nowadays, most of the phytochemical screening dealt with plant parts other than flowers [41-44]. So far there are only a few studies on phytochemical and pharmacological evaluation of flower extracts. Hence this study was carried out to explore the phytochemical constituents of the solvent extracts of eight different flowers.

MATERIALS AND METHODS

The flowers of *Dillenia pentagyna* Roxb., *Garcinia gummigutta* L., *Hamelia patens* Jacq., *Hyptis suaveolens* (L.) Poit, *Ipomea tricolor* Cav., *Ixora coccinea* L., *Ochna obtusata* DC. and *Pentas lanceolata* (Forssk) Deflers were collected from Scott Christian College (Autonomous), Tamilnadu, India and identified using the Flora of Scott Christian College Campus [45]. Extracts were prepared from fresh flowers. Aqueous, petroleum ether, chloroform, ethanol and acetone were used as solvents for the extraction of flowers. Extracts were prepared by soaking 50g each of the flowers in 200ml of each solvent in a conical flask and shaked at room temperature for 24h. After 24h, the extracts were filtered through a Whatman No.1 filter paper and the filtrates were subjected to preliminary chemical tests using standard procedure [46].

RESULTS

Preliminary phytochemical screening was performed in various floral extracts of *Dillenia pentagyna*, *Garcinia gummigutta*, *Hamelia patens*, *Hyptis suaveolens*, *Ipomea tricolor*, *Ixora coccinea*, *Ochna obtusata* and *Pentas lanceolata*. The result of the preliminary phytochemical analysis of flower extracts is listed in Table 1. Aqueous extract of the flower of *Dillenia pentagyna*, showed the availability of coumarins, glycosides, phytosterols, proteins, saponins and sterols. Saponins are found only in petroleum ether extract. Chloroform extract revealed the presence of carbohydrates and saponins. Ethanol extract showed the presence of alkaloids, flavonoids, glycosides, phenols, steroids, terpenoids and quinones whereas acetone extract showed the availability of alkaloids, flavonoids, phytosterols, phenols and proteins.

In *Garcinia gummigutta* aqueous extract showed the presence of secondary metabolites like carbohydrates, proteins, phytosterols, glycosides and terpenoids. Chloroform extract showed the availability of alkaloids, carbohydrates, coumarins, flavonoids, glycosides, terpenoids and steroids. Alkaloids, coumarins, flavonoids, phenols, phytosterol, proteins, steroids and terpenoids were found in the ethanol extract. Acetone extract showed the presence of coumarins, flavonoids, glycosides, phytosterols, steroids and terpenoids. Carbohydrates, coumarins, glycosides, steroids and terpenoids were found in petroleum ether extract. Quinones and saponins were found to be absent in all the *G. gummigutta* extracts. Aqueous floral extract of *Hamelia patens* revealed the presence of alkaloids, carbohydrates, flavonoids, glycosides, phenols, proteins, quinones, saponins, steroids

and terpenoids. Carbohydrates, flavonoids and glycosides were noticed in petroleum ether extract. Chloroform extract showed the presence of carbohydrates, coumarins, flavonoids, phenols, phytosterols, proteins, steroids and terpenoids. Ethanol extract showed the availability of carbohydrates, coumarins, flavonoids, phenols, quinones, saponins, steroids and terpenoids whereas, coumarins, flavonoids, phenols, proteins, quinones, saponins and terpenoids were noticed in acetone extracts.

The crude flower extract of *Hyptis suaveolens* showed the presence of alkaloids, coumarins, carbohydrates, proteins, quinones, saponins, steroids and terpenoids in aqueous extract. Alkaloids, phytosterols, steroids and terpenoids were reported in petroleum ether extract. Chloroform extract showed the presence of alkaloids, carbohydrates, phytosterols, quinones, steroids and terpenoids. Ethanol extract showed the presence of coumarins, flavonoids, quinones, sterols and terpenoids. Whereas acetone extract showed the presence of coumarins, flavonoids, phytosterols, glycosides, terpenoids, proteins and steroids. Glycosides and phenols were found to be absent in all the extracts.

Aqueous extract showed the availability of alkaloids, carbohydrates, flavonoids, phenols, phytosterols, proteins, quinones, saponins and steroids in *Ipomea tricolor*. Alkaloids, phytosterols and quinones were noticed in petroleum extract. Chloroform extract revealed the presence of alkaloids, proteins, quinones, steroids and terpenoids. Coumarins, flavonoids, phenols, phytosterols, steroids and terpenoids were reported in ethanol extract. Acetone extract showed the presence of coumarins, flavonoids, phenols, phytosterols, proteins, quinones and terpenoids.

Phenolic compounds were found only in aqueous extract of *Ixora coccinea*. Petroleum ether extract contains phytosterols and terpenoids. Chloroform extract showed the presence of carbohydrates and terpenoids. Coumarins, carbohydrates, phytosterols, steroids and terpenoids were noticed in ethanol extracts. Acetone extract showed the presence of coumarins, phenols, glycosides, phytosterols, saponins and terpenoids whereas flavonoids, quinones, proteins and sterols were absent in all the extracts.

In *Ochna obtusata*, aqueous extract showed the presence of carbohydrates, flavonoids, phenols, phytosterols, proteins and quinones. Petroleum ether extract showed the presence of phenols, proteins, saponins and terpenoids. Chloroform extract showed the presence of carbohydrates, coumarins, phenols, phytosterols, proteins, quinones and steroids. Ethanol extracts showed the presence of flavonoids, coumarins, phenols, proteins, quinones, steroids and terpenoids whereas acetone extract showed the presence of flavonoids, phytosterols, quinones, proteins, terpenoids and steroids.

The aqueous extract of *Pentas lanceolata* flowers showed the presence of carbohydrates, coumarins, flavonoids, phenols, quinones and terpenoids. Steroids were noticed only present in aqueous extract whereas, carbohydrates, coumarins, phytosterols terpenoids and steroids were present in chloroform extract. Acetone extract showed the presence of coumarins, flavonoids, phenols and terpenoids. Saponins, proteins and glycosides were not detected.

Table. 1 Phytochemical constituents of certain flower extracts

		Alkaloids	Carbohydrates	Coumarins	Flavonoids	Glycosides	Phenols	Phytosterols	Proteins	Quinones	Saponins	Sterols	Terpenoids
Dillenia pentagyna	Aqueous	-	-	++	-	++	-	+	++	-	++	+	-
	P. ether	-	-	-	-	-	-	-	-	-	+++	-	-
	Chloroform	-	+++	-	-	-	-	-	-	-	+++	-	-
	Ethanol	+	-	++	+++	-	+	+	-	++	-	++	++
	Acetone	+	-	-	+++	-	++	+	+++	-	-	-	-
Garcinia gummi-gutta	Aqueous	-	++	-	-	++	-	++	+++	-	-	-	+++
	P. ether	-	+	++	-	+	-	-	-	-	-	++	+
	Chloroform	++	+++	++	+++	+	-	-	-	-	-	+	+
	Ethanol	+	-	+++	++	-	+++	+	++	-	-	+++	++
	Acetone	-	-	++	++	-	+++	+	-	-	-	++	++
Hamelia patens	Aqueous	++	+	-	++	+	++	-	+	+++	+	+	++
	P. ether	-	+	-	+++	+	-	-	-	-	-	-	-
	Chloroform	-	+++	++	+++	-	+++	+++	++	-	-	++	+++
	Ethanol	-	-	++	+++	-	+++	-	-	++	+++	++	+++
	Acetone	-	-	++	++	-	+++	-	+	++	+++	-	+++
Hyptis suaveolens	Aqueous	++	-	+	+++	-	-	-	+	++	+	+	+++
	P. ether	++	-	-	-	-	-	++	-	-	-	+	+
	Chloroform	++	+++	-	-	-	-	++	-	+	-	+	+
	Ethanol	-	-	++	+	-	-	++	-	+	-	+++	++
	Acetone	-	-	+++	++	-	-	++	+	-	-	++	++

Ixora coccinea	Aqueous	-	-	-	-	-	++	-	+	+++	+	+	++
	P. ether	-	-	-	-	-	-	-	-	-	-	-	-
	Chloroform	-	+++	-	-	-	+++	+++	++	-	-	++	+++
	Ethanol	-	-	+	-	-	+++	-	-	++	+++	++	+++
	Acetone	-	-	+	-	+	+++	-	+	++	+++	-	+++
Ipomea tricolor	Aqueous	+++	+++	-	++	-	+++	+++	++	+++	+++	+++	+
	P. ether	+++	-	-	-	-	-	++	-	++	-	-	_
	Chloroform	++	-	-	-	-	-	-	+++	+++	-	+++	++
	Ethanol	-	-	++	++	-	+	++	-	-	-	+++	++
	Acetone	-	-	+	++	-	+	+++	+	+	-	-	++
Ochna obtusata	Aqueous	-	++	-	++	-	+++	+	++	++	-	-	-
	P. ether	-	-	-	-	-	++	-	++	-	++	-	++
	Chloroform	-	+++	+++	-	-	++	++	+	+	-	++	-
	Ethanol	-	-	+	+++	-	+++	-	++	+	-	+++	+++
	Acetone	-	-	-	++	-	-	+++	+	+	-	+	+++
Pentas lanceolata	Aqueous	-	++	+	+++	-	+++	-	-	++	-	-	+++
	P. ether	-	-	-	-	-	-	-	-	-	-	++	-
	Chloroform	-	+++	++	-	-	-	++	-	-	-	++	++
	Ethanol	+	+	-	+++	-	+++	++	-	++	-	-	++
	Acetone	-	-	++	+++	-	+++	-	-	-	-	-	+++

Abbreviation: +++ Maximum concentration; ++ Medium concentration; + Low concentration; - No concentration

DISCUSSION

Phytochemical screening of the flowers showed some differences in the presence of phytoconstituents which are known to have importance in medicine [47-51] The preliminary screening tests may be useful in the detection of the bioactive principles and subsequently may lead to the drug discovery and development [52-55].

In the present study, the successive extraction flowers of Dillenia *pentagyna* in different solvents revealed the presence of all phytoconstituents. Flavonoids and alkaloids were found in ethanol and acetone extracts of the plant. It was reported that chloroform extract of the leaves contains alkaloids such as ellipticine, camptothecin are applied as clinical anticancer drugs [56]. Such alkaloids were effective against ovarian, brain, breast, lung cancer etc [57-60] and several of its semisynthetic analogues are 9-Nitro-CPT, 10-hydroxy-9-dimethylaminomethyl - CPT, 7-Ethyl- 10 -hydroxy-camptothecin (SN-38), are applied as clinical anticancer drugs in USA, Europe and Japan [61]. Other alkaloids include indicine, indicine N- oxide, thalicarpine and tetrandrine [62]. Flavonoids are also reported to have inhibitory action on growth and proliferation of different types of tumors [63].

The crude flower extracts of *Garcinia gummigutta* contains the phytoconstituents such as alkaloids, carbohydrates, coumarins, proteins, phytosterols, flavonoids, glycosides, phenols, steroids and terpenoids. The aqueous, petroleum ether, diethyl ether, chloroform, ethanol, acetone, hexane and methanol extracts of the leaves showed the availability of alkaloids, tannins, flavonoids, carbohydrates, proteins, terpenoids, steroids and glycosides [64]. Alkaloids are used medicinally; they provide information to determine lead structures of novel synthetic drugs. These compounds have antimicrobial activity by inhibiting DNA topoisomerase [65]. Selvam *et al*. reported that methanolic extract of the *G. gummigutta* fruit had antioxidant activity and anti hepatotoxic activity due to the presence of protein [66]. In a previous study water, methanol, ethanol, acetone, chloroform, diethyl ether, petroleum ether, hexane extracts showed the presence of higher quantities of tannins in methanol and ethanol extracts. Tannins are potential toxic agents of fungi, bacteria and viruses in plants and also human medicinal use to help reduce the risk of coronary heart diseases [67].

All the tested phytochemicals were detected in different extracts of the plant *Hamelia patens*. The flower extract of the *H. patens* revealed the presence of alkaloids, carbohydrates, flavonoids, glycosides, phenols, proteins, quinones, saponins, steroids, coumarins, phytosterols and terpenoids. The plants are used in folk medicine against a range of ailments such as athlete's foot, skin lesions and rash, insect bites, nervous shock, inflammation, rheumatism, headache, asthma and dysentery [68]. A number of active compounds have been found in firebush, including maruquine, isomaruquine, pteropodine, isopteropodine, palmirine, rumberine, seneciophylline and stigmast-4-ene-3, 6-dione [18]. Fire bush contains 17.5 percent crude protein and has *in vitro* digestibility of 61.6 percent [17].

Preliminary phytochemical analysis of the various flower extracts of *Hyptis suaveolens* contained sterols, flavonoids, tannins, glycosides, carbohydrates, alkaloids and proteins. *Hyptis* is reported to promote wound healing due to the presence of flavonoids and triterpenoids [69, 70]. Antimicrobial property of this plant is mainly due to their astringent nature and tannins [22, 71,72]. Shenoy *et al*. reported that the phytochemical screening of different leaf extracts (petroleum ether, solvent ether, chloroform, alcohol and chloroform water) of this plant had alkaloids, steroids, glycosides, flavonoids, tannins and carbohydrates [73]. However no previous reports are available in the phytochemistry of floral extracts.

The phytochemical examination of *Ipomea tricolor* indicated the presence of alkaloids, carbohydrates, coumarins, flavonoids, glycosides, phenols, phytosterols, proteins, quinones, saponins, steroids and terpenoids. *I. tricolor* leaves had aminooxy-p-phenyl propionic acid and the plants are having tannins and insecticidal components like cholestan-3-one [74]. The leaves have ergoline alkaloids and its derivatives (lysergamides) are probably responsible for the ethnogenic activity. Ergine (LSA), Isoergine, D-lysergic acid and N-(alpha-hydroxyethyl)amide and Lysergol have been isolated from *I. tricolor*, *I. violacea* and *I. purpurea* [24]. Sathyaraj and Ravi proved that the carbohydrates, phenolic compounds, saponins, tannins steroids, xanthoproteins, alkaloids and flavonoids are present in the benzene and chloroform extract of the *I. cornea* leaves[75]. Preliminary phytochemical screening of *Ipomea obscura* leaf, stem and seed extract in different solvent like petroleum ether, alcohol, chloroform, acetone and chloroform water found secondary metabolites like alkaloids, phenolics, flavonoids and saponins [11,76].

The floral extracts of *Ixora coccinea* showed the presence of phenolic compounds, terpenoids, phytosterols, saponins, coumarins, carbohydrates and glycosides. Similar studies were conducted by Maniyar *et al*. on the aqueous extract of flowers and biomolecules such as alkaloids, glycosides, tannins and flavonoids were noticed [77] whereas, Ragasa *et al*. reported that *I. coccinea* flowers contains flavonoids, steroids and tannins and also have two new cycloartenol esters, lupeol fatty ester, lupeol, ursolic acid, oleanolic acid and sitosterol [78]. Fifty four components were extracted from the essential oil of *I. coccinea* flower extract [79]. The oil is composed of monoterpenes like geranyl acetate, sesquiterpenes like cyperene, copaene and triterpenes such as linalyl acetate, neryl acetate, terpineol acetate, borneol aceate and ethyl cinnamate. Chemoprotective effects are due to the presence of triterpenoids and ursolic acids [80]. The plant was reported to have cytotoxic and antitumor activity [81]. Dried leaves have antimicrobial activity [82], antinociceptive activity [83] and antioxidant capacity [84,85] due to the presence of phenolics, DPPH free radical scavenging activity and reducing power is due to the presence of flavonoids [86]. Nagaraj *et al*. reported the synthesis of gold nanoparticles in aqueous medium using flower extracts of *I. coccinea* as reducing and stabilizing agents [87].

The various phytochemical compounds detected from the flowers of *Ochna obtusata* revealed the presence of carbohydrates, coumarins, flavonoids, phenols, phytosterols, proteins, quinones, saponins, steroids and terpenoids. Sriram *et al*. reported that the ethanol and chloroform leaf extracts of the plant showed the presence of biomolecules such as flavonoids, steroids, glycosides, sugars, alkaloids, saponins, coumarins and had antibacterial activity against *Bacillus subtilis*, *Enterococcus faecalis* and *Proteus mirabilis* [88]. The aqueous and methanol extracts from the leaves *O. obtusata* are potent inhibitors of gastric mucosal lesions caused by ethanol, indomethacin, pylorus ligation and cold-resistant stress in rats and also possess anti-ulcer properties [89].

The phytochemical studies of the floral extract of the *Pentas lanceolata* showed the presence of biomolecules such as alkaloids, carbohydrates, coumarins, flavonoids, phenols, phytosterols, quinones, terpenoids and steroids. *P. lanceolata* showed wound healing activity due to the presence of tannins [90]. Root and leaf extracts were used to treat lymphadenitis by topical and oral routes [91]. In case of snake bite, crushed fresh root is homogenized in water, drunk or any fresh part of the whole plant is chewed [92]. Decoction of roots is taken as remedy for gonorrhea, syphilis and dysentery [93]. The methanolic extract of the roots of *P. lanceolata* had seven known anthraquinones like rubiadin-1-methyl ether [94], damnacanthal and lucidin-ω-methyl ether and also showed moderate antiplasmodial activities [95].

CONCLUSION

The flowers of *Dillenia pentagyna*, *Garcinia gummigutta*, *Hamelia patens*, *Hyptis suaveolens*, *Ipomea tricolor*, *Ixora coccinea*, *Ochna obtusata* and *Pentas lanceolata* studied here contained many bioactive chemical constituents including alkaloids, carbohydrates, phytosterols, proteins, glycosides, coumarins, quinones, saponins, terpenoids, steroids, flavonoids and phenols and can serve as potential source of drugs with biological importance. Extensive literature survey revealed that the flower extracts of medicinal plants showed many chemical constituents which are responsible for varied pharmacological and medicinal property which can be used for the welfare of the mankind. Further research is necessary to find the active compounds present in the flower extracts to treat human diseases.

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