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Review Article

A systematic review on phytochemistry and biological activities of *Ixora parviflora* Vahl. (Rubiaceae family)

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ABSTRACT

"Torch tree", or *Ixora parviflora* Vahl.," commonly known as the "torch tree," is a member of the Rubiaceae family. This small, densely branching evergreen tree or shrub is found throughout much of India, extending from the Gangetic plain in the east to Assam and southward to Kerala and the Nicobar Islands. The plant is known for its numerous therapeutic properties and has a long history of use in treating a wide range of ailments, including skin conditions, kidney disorders, whooping cough, anemia, general debility, and urinary tract infections. Various phytoconstituents have been identified in *I. parviflora*, primarily flavonoids such as β-sitosterol, quercetin, and kaempferol, as well as fragrant and acrid oils, alkaloids, tannins, glycosides, terpenoids, and carbohydrates. The goal of this review is to summarize the existing literature on *I. parviflora*, focusing on its traditional uses, chemical constituents, and pharmacological activities.

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1. Introduction

Herbal medicine, also known as botanical medicine or phytomedicine, utilizes various parts of plants—such as seeds, fruits, leaves, bark, and flowers—for the treatment of a wide range of medical conditions (Joshi et al., 2024; Logeswaran and Vellingiri, 2024). Throughout the history of civilization, cultures across all ages have practiced healthcare using herbal medicine for both humans and animals (Mohammadhosseini and Jeszka-Skowron, 2023). Today, herbal medicine remains one of the most popular healthcare system in all over the world. Before 19th century, herbal medicines were given in their crude form as different formulations like infusion (herbal tea), tinctures (alcoholic extract), decoction (boiled extract of different parts of plant), syrup, herbal baths and external applications such as ointments, poultices, balms and essential oils (Mohammadhosseini et al., 2019, 2021). However, scientists started isolating, purifying and identifying the bioactive components from medicinal plants in the late 19th century. Even in cases where access to conventional healthcare facilities is provided, traditional medicine has traditionally been viewed from cultural standpoint as an effective and desirable choice. Recent developments in the fields of biochemistry, immunology, medicinal botany and Pharmacognosy have demonstrated the descriptive power, efficacy and logic of herbal remedies (Chikezie et al., 2015). The WHO has issued extensive guidelines to assess the quality, safety and efficacy of herbal medicine. Over the last few decades, non-prescription drug users have increased their use of herbal medications (Vishvambar et al., 2023). Approximately, 25% of medications prescribed globally are derived from plants, with 121 active chemical compounds from plants currently in use. World health

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organization (WHO) considers 252 medications as basic and essential, out of these medications only 11% are solely coming from plants and specific number of synthetic drugs are derived from natural precursors. Plants are by a mile the most plentiful and economical renewable resource that is specially suited to intricate biochemical synthesis. Plants will become even more compatible in the future due to rising cost of energy and chemical raw materials as well as the environmental issues surrounding the production of conventional pharmaceuticals (Raghavendra et al., 2020).

The genus *Ixora* belongs to the Rubiaceae family and comprises approximately 400 species, primarily found in tropical regions of Asia, Africa, and Oceania, with 19 species unique to southern China. *Ixora* plants are easily cultivated as common roadside and garden plants, characterized by their small, graceful flowers. Various species of *Ixora* have been utilized in traditional medicine to treat a range of illnesses (Li et al., 2016; Wonkam et al., 2022). *Ixora* plants contain well-known secondary metabolites, including flavonoids, alkaloids, saponins, steroids, alkenes, and terpenoids. These phytocompounds have demonstrated a variety of medicinal properties, including antimicrobial, hepatoprotective, gastroprotective, antinociceptive, antimutagenic, antineoplastic, and chemoprotective effects. Recent research has revealed that the phytoconstituents of *Ixora parviflora*, such as flavonoids and phenolic compounds, exhibit antioxidant, anti-inflammatory, and anti-photoaging properties (Kan et al., 2013). *Ixora* genus is found worldwide in tropical and subtropical areas, growing as shrubs and small trees. India is home to about 30 species, and many exotic varieties are cultivated in gardens. Although they bloom throughout most of the year, they are particularly striking during the summer and rainy seasons. The application of liquid manure during flowering and careful pruning after blooming are beneficial practices. Because the flowers remain fresh for an extended period, they are highly valued as cut flowers. Reports indicate that local communities use the fruits and roots as an antidote for discolored urine. The flowers are also used to treat whooping cough by being pounded in milk. For general debility and anemia, a decoction made from the bark is employed.

Sandals consume the ripe fruit, while buffaloes feed on the leaves. The wood has a smooth, fine-grained texture and is brown, hard, and heavy. It is suitable for turning and engraving, but it requires thorough polishing. Although it is available in limited quantities, it has been reported to be used as fuel; the twigs burn readily and are utilized to make torches (Krishnan Marg, 2008). However, to the best of our knowledge, no comprehensive review has been conducted to date on the traditional uses, pharmacognostical properties, phytochemical studies, and pharmacological applications of the plant *I. parviflora* Vahl.

2. Methodology

All papers used in the preparation of this review were gathered from various scientific databases, including Google Scholar, ScienceDirect, MDPI, Web of Science, and PubMed, using the following keywords: *I. parviflora* Vahl., pharmacognosy, phytochemistry, and the biological functionalities of *I. parviflora*. The articles were selected based on their scientific rigor and significance. Studies exploring the beneficial properties of *I. parviflora* were integrated, and the search was restricted to articles published in English. This review was prepared in 2024.

3. General description

3.1. Habitat

A genus of shrubs and small trees is distributed across the tropical and subtropical regions of the world. Approximately, 30 species are found in India, with many exotic varieties cultivated in gardens. *I. parviflora* is a small, widely branching evergreen shrub or tree that can be found throughout most of India, ranging from the Gangetic plains in the east to Assam and extending south to Kerala and the Nicobar Islands (Krishnan Marg, 2008).

3.2. Plant profile

Plant name: *Ixora parviflora* Vahl.; Common name: Small flowered *Ixora;* Synonym: *Ixora arborea* Roxb., *Ixora pavetta* Andr.; Family: Rubiaceae (Krishnan Marg, 2008).

3.3. Common names

Ixora parviflora Vahl., is a flowering plant that is traditionally known by traditionally Tamil: Shulundu-kora, Korivi; English: Torch tree, Torch wood *Ixora;* Telugu: Korivipala, Puttupala, Kachipadel, Gorivi; Kannada: Gorabikattige, Kansuragi; Hindi: Kotagandhal, Nevari; Sanskrit: Iswara, Nevali; Marathi: Kurat, Raikura (Krishnan Marg, 2008).

3.4. Taxonomical classification

Kingdom: Plantae-plants; Subkingdom: Tracheobionta-vascular plants; Division: Magnoliophyta-flowering plant; Class: Magnoliopsida-dicotylidons; Subclass: Asteridae; Order: Rubiales; Family: Rubiaceae; Genus: *Ixora;* Species: *parviflora* (Shastry et al., 2022).

3.5. Plant characteristics and morphology

The evergreen tree reaches a height of 10 meters, with bark that is 5-6 mm thick, dark brown, and featuring pink blazes along its woody branchlets (Fig. 1). The leaves are simple, opposite, and decussate, with interpetiolar stipules that are ovate-acuminate. The petiole measures 4-8 mm in length, is stout, and glabrous. The lamina is elliptic, elliptic-obovate, obovate, or obovate-oblong, measuring 6-14 cm by 3.5-7.5 cm, with a base that is obtuse or rounded and subcordate, and an apex that is

obtuse. The leaf margin is entire, glabrous, and thickly coriaceous, with 10-15 pairs of very slender, pinnate lateral nerves that are prominently visible on the underside. The fresh flowers are bisexual, measuring 5-6 mm in length, white in color, and arranged in large, fragrant, corymbose terminal cymes. The calyx consists of 4 short sepals, while the corolla has 4 lobes that are oblong and recurved, with a corolla tube measuring 6 mm in length. The androecium comprises 4 stamens attached to the mouth of the corolla, with sagittate anthers. The ovary is inferior, with two cells, each containing one ovule; the style is expelled, and the stigma is bifid. The berries are black, globose, approximately 0.25 inches in diameter, and somewhat didymous. The seeds are plano-convex (Krishnan Marg, 2008; Shastry et al., 2022).

4. Phytochemistry

The various parts of the *Ixora* genus are widely used in folk medicine, which has prompted the chemical analysis of many species. According to phytochemical analyses, the majority of plants in the Rubiaceae family contain flavonoids. Other classes of chemical compounds present in these plants include fatty acids, tannins, saponins, alkaloids, and aromatic oils (Table 1, Fig. 2, Fig. 3, Fig. 4, Fig. 5). Kharat et al. (2013) reported that the phytoconstituents eluted from the chloroform extract of *I. parviflora* over a silica gel column were identified as β-sitosterol, kaempferol, β-sitosterol-β-D-glycoside, and kaempferol-7-*O*-methyl ether. *I. parviflora* contains a variety of chemical constituents, including phytosterols such as β-sitosterol and β-sitosterol-β-D-glucoside. The flavonoids present include kaempferol, apigenin, quercetin, rutin, kaempferol-7-*O*-methyl ether, quercetin-3-*O*-D-galactopyranoside, apigenin-7-*O*-D-glucopyranoside, polyphenol esters, and chlorogenic acid. Additionally, several saturated fatty acids are present, including capric, myristic, stearic, lauric, arachidic, palmitic, behenic, oleic, and linoleic acids (Deepa et al., 2023). This plant yields a variety of chemical constituents, including terpenoids, phenylpropionic acid, coumarins, flavonoids, and steroids. The floral essential oil from *I. parviflora* has been shown to contain minimal levels of diterpenes and oxygenated sesquiterpenes, although it is predominantly rich in oxygenated monoterpenes (83.30%), with trans-hotrienol (51.66%) being the main phytoconstituent. From *I. parviflora*, long-chain fatty acids, alcohols, esters, and alkanes have been extracted. According to the liposoluble components of the plant, the primary fatty acid found in *I. parviflora* is palmitic acid (Li et al., 2016). From the aerial parts of *I. parviflora*, β-sitosterol, kaempferol, β-sitosterol-β-D-glycoside, and kaempferol-7-*O*-methyl ether were isolated and identified. The structures of these compounds were confirmed through extensive use of nucleus magnetic resonance (NMR), ultraviolet (UV), and infrared (IR) spectroscopy (Bachheti et al., 2011).

5. Traditional uses

I. parviflora leaf extract has demonstrated antiviral, hypotensive, and spasmolytic properties. The flowers of this plant are utilized in the treatment of ulcers and whooping cough, while the roots are used to address menorrhagia (Kharat et al., 2013). Additionally, the fruits and roots are reputed to serve as an antidote for discolored urine. A decoction of the bark is employed to treat anemia and general debility (Krishnan Marg, 2008).

6. Biological, pharmacological and medical activities of Ixora parviflora Vahl.

6.1. Antioxidant activity

I. parviflora contains a significant amount of polyphenols, which exhibit antioxidant properties and reduce the generation of reactive oxygen species (ROS) intracellularly when induced by UVB radiation (Table 2). Pharmacological experiments assessing photo-aging activity demonstrated that the extract of *I. parviflora* at a concentration of 1000 µg/mL decreased the activity of collagenase and elastase enzymes in bacteria by 92.7 ± 4.2% and 32.6 ± 1.4%, respectively (Kharat et al., 2013). In addition to preventing the formation of ROS in human fibroblasts (Hs68), the crude extract of *I. parviflora* also exhibited antioxidant properties in erythrocytes and a cell-free system following UV light exposure (Deepa et al., 2023). The enzymatic antioxidants in the liver, such as glutathione, catalase, and superoxide dismutase, were significantly elevated in response to the enteral administration of a methanolic extract of the entire I. pavetta plant at various dose levels of 100, 200, and 400 mg/kg (Suneeta et al., 2020). A range of analytical results was observed for the *I. parviflora* extract at 1000 µg/mL: 90.5 ± 0.6% for reducing capacity, 96.0 ± 0.4% for 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity, 72.2 ± 3.5% for iron chelating activity, 96.8 ± 1.4% for hydroxyl radical scavenging effect, and 99.5 ± 3.3% for hydrogen peroxide scavenging assay. At a concentration of 500 µg/mL, the extract of I. *parviflora* also exhibited an inhibitory effect against hemolysis of red blood cells (RBCs) induced by 2,2′-azobis (2-methylpropionamidine) dihydrochloride (APPH), with an inhibition rate of 89.4 ± 1.8%, and reduced the generation of ROS in UV-exposed fibroblasts by 52.9% (Wen et al., 2011). Based on these studies, the extract of *I. parviflora* is a potent antioxidant and a powerful anti-photo-aging agent.

6.2. Anti-ulcer activity

The ethanolic extract of the flowers of *I. parviflora* was evaluated for its antiulcer properties by inducing ulcers using aspirin and ligating the pylorus of rats. When the aspirin-induced and pylorus-ligated rats were administered the plant extract, a significant reduction in gastric acid secretion, free acidity, and the incidence of gastric ulcers was observed (Table 2). Omeprazole, an established antiulcer medication, was used as a standard for comparison of the antiulcer effects (Srinivas et al.,

Fig. 1. The photographs of an *Ixora parviflora* Vahl.

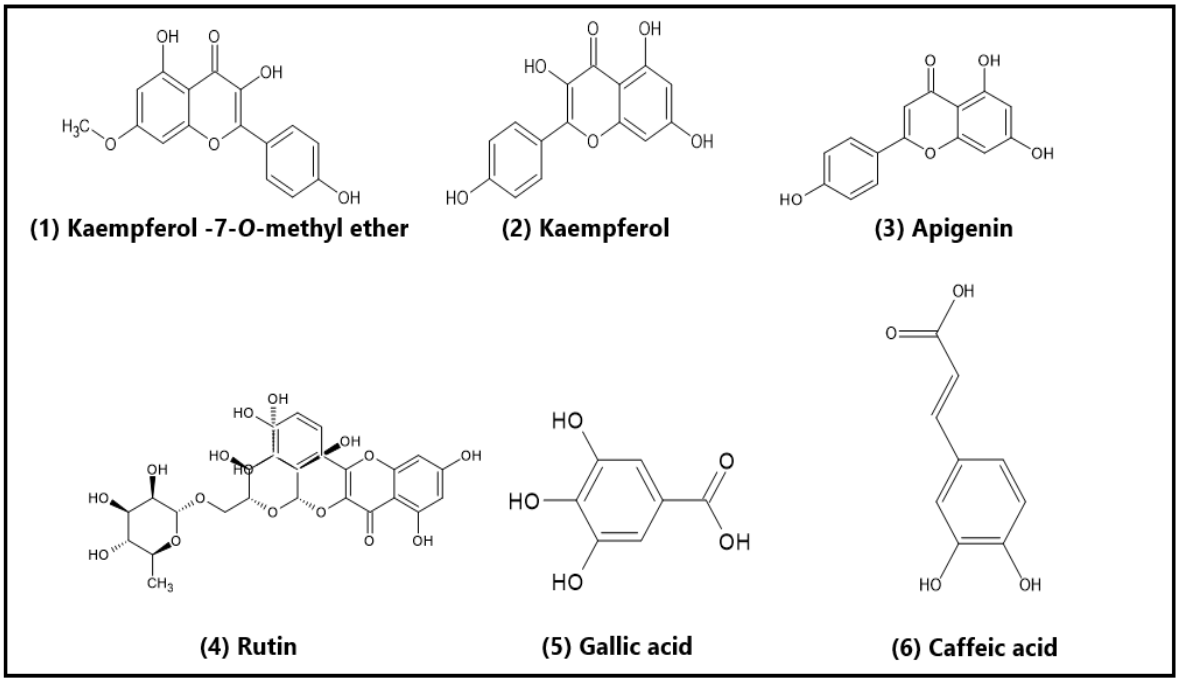

Fig. 2. Structures of flavonoids found in *Ixora parviflora* Vahl.

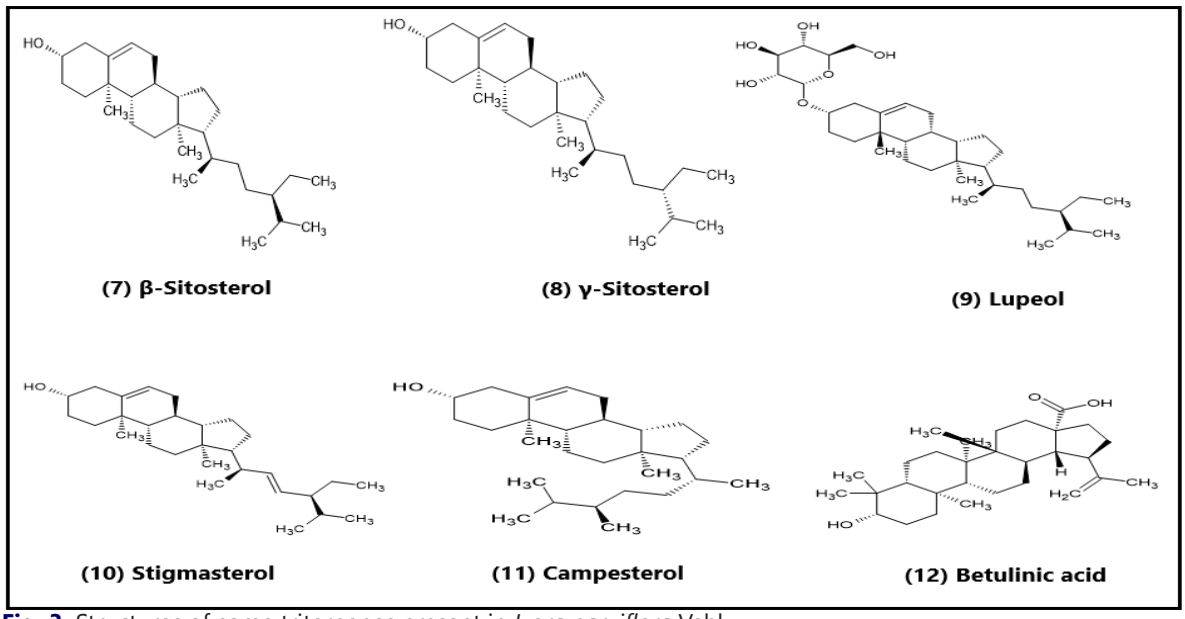

Fig. 3. Structures of some triterpenes present in *Ixora parviflora* Vahl.

Table 1
Phytochemical contents of different parts of *Ixora parviflora* Vahl.

Part of plant	Place of collection	Extraction method/ Solvent	Identification method	Name of the compound	References
Flavonoids					
Aerial parts	Uttarakhand, India	Chloroform extract	Elemental analysis, UV, IR, NMR, EI-MS spectroscopy	Kaempferol, kaempferol-7-O-methyl ether	Bachheti et al., 2011
Aerial parts	Uttarakhand , India	Chloroform extract	Column chromatography	Rutin, Cyanidin-3-rutinoside and Kaempferol-3 -rutinoside	Kharat et al., 2013
Flowers	Egypt	Petroleum ether	Chromatographic analysis	Apigenin, Apigenin-7-O-β-D-glucopyaranoside, Apigenin-5-O-β-D-galactopyranoside, Chrysin-5-O-β-D-xylopyranoside, Quercetin and Quercetin-3-O-β-D-galactopyranoside	Li et al., 2016
Leaves	Telangana, India	Hexane, Ethyl acetate, Methanol	GC-MS analysis	Gallic acid, Caffeic acid and Apigenin	Srivani et al., 2023
Triterpenes					
Aerial parts	Uttarakhand, India	Chloroform extract	Elemental analysis, UV, IR, NMR, EI-MS spectroscopy	β-Sitosterol, β- Sitosterol-β-D - glucoside	Bachheti et al., 2011
Flowers	Egypt	Petroleum ether	Chromatographic analysis	β-Amyrin, Lupeol and Lupeol acetate	Li et al., 2016
Leaves	Telangana, India	Hexane, Ethyl acetate, Methanol	GC-MS analysis	Betulin; Oleanolic acid; Betulinic acid; 2,6,10,14,18,22-Tetracosahexane; γ-Sitosterol; Lup- 20(29)-en-3-ol,acetate,(3-β); Phytol; Stigmasterol; 9,19-cyclolanostan- 3-ol,2H-methylene- (3-β); Campesterol; Cholest-5-en-3-ol and Lupeol	Srivani et al., 2023
Coumarins					
Flowers	Egypt	Petroleum ether	Chromatographic analysis	6,7-Dimethyoxycoumarin	Li et al., 2016
Phenyl propionic acid					
Flowers	Egypt	Petroleum ether	Chromatographic analysis	Chlorogenic acid	Li et al., 2016
Leaves	Telangana, India	Hexane, Ethyl acetate, Methanol	GC-MS analysis	Chlorogenic acid	Srivani et al., 2023
Fatty acids and their derivatives					
Aerial parts	Uttarakhand, India	Chloroform extract	Column chromatography	Palmitic acid, Oleic acid, Stearic acid and Linolic acid	Kharat et al., 2013
Leaves	Telangana, India	Hexane, Ethyl acetate, Methanol	GC-MS analysis	7-Hexadecenal; Octadecanoic acid; Tetrapentacontane; 9-Eicosene; 8- Pentadecanone; 3,7,11,15-Tetramethyl-1,2-hexadecen-1-ol; Pentadecanoic acid; Pentatriacontane and Heptacosanoic acid, methyl ester	Srivani et al., 2023
Amino acids					
Aerial parts	Uttarakhand, India	Chloroform extract	Column chromatography	Cycteine, Proline, Glycine and Serine	Kharat et al., 2013

Table 1
Continued

Part of plant	Place of collection	Extraction method/ Solvent	Identification method	Name of the compound	References
Sugars					
Aerial parts	Uttarakhand, India	Chloroform extract	Column chromatography	D-Glucose, D-Mannitol	Kharat et al., 2013
Leaves	Telangana, India	Hexane, Ethyl acetate, Methanol	GC-MS analysis	3-O-Methyl-D-glucose	Srivani et al., 2023
Vitamins					
Leaves	Telangana, India	Hexane, Ethyl acetate, Methanol	GC-MS analysis	1-(+)-Ascorbic acid 2,6-dihexadecanoate; β- Tocopherol; Vitamin- E; Vitamin-E acetate and 3,4-dihydro-2,8-dimethyl-2H-1 benzopyran-6-ol	Srivani et al., 2023
Others					
Flowers	Egypt	Petroleum ether	Chromatographic analysis	Cetyl alcohol	Li et al., 2016
Leaves	Telangana, India	Hexane, Ethyl acetate, Methanol	GC-MS analysis	1,2,3,5-Cyclohexanetetrol; Silane [(1,1-dimethyl-2- propenyl)oxy] dimethyl- ; 1,2-Benzenediol; Heneicosane; 2-ethyl-3-methyl butanal and Nitrocyclohexane	Srivani et al., 2023

2011).

6.3. Antimicrobial activity

Using the agar well diffusion method, a methanolic extract of *I. parviflora* leaves demonstrated strong antibacterial properties against *Salmonella paratyphi*, *Bacillus subtilis*, *Salmonella typhi*, and *Acinetobacter baumannii*. The antibacterial activity was compared to that of gentamicin (Table 2) (Akter et al., 2015).

6.4. Hepatoprotective activity

After a strenuous exercise challenge, the extract of *I. parviflora* improved antioxidant enzyme activity and the expression of superoxide dismutase (SOD) protein, reduced lipid peroxidation, and suppressed the expression of the NADPH oxidase complex in the liver. According to these findings, this plant demonstrates liver-protective and antioxidative properties when used *in vivo* (Kan et al., 2013). At various dosage levels (100, 200, and 400 mg/kg), there was a significant dose-dependent decrease in serum biochemical markers of liver function, such as serum glutamate pyruvate transaminase (SGPT), serum glutamate oxaloacetate transaminase (SGOT), alkaline phosphatase (ALP), and bilirubin, along with an increase in total protein levels (Table 2). The enzymatic antioxidants in the liver, including glutathione, catalase, and superoxide dismutase, were significantly elevated in response to the oral administration of the methanolic extract of the entire *I. pavetta* plant at the aforementioned dosage levels. Based on this pharmacological screening, the methanolic extract of the whole I. pavetta plant exhibits hepatoprotective effects similar to those of the standard drug silymarin. These activities may be attributed to the presence of phytoconstituents such as flavonoids, glycosides, saponins, tannins, phenols, and triterpenoids in the methanolic extract of the entire *I. parviflora* plant (Suneeta et al., 2020).

6.5. Analgesic activity

When administered orally to mice, the ethanolic extract of *I. pavetta* leaves (EEIPL) significantly reduced writhing induced by acetic acid, demonstrating effects comparable to aspirin ($p < 0.01$) (Table 2). Analgesic studies indicated a dose-dependent response to the extract against thermally induced pain. In rats, intraperitoneal administration of EEIPL at doses of 200, 400, and 600 mg/kg significantly inhibited both the early and late phases of formalin-induced pain ($p < 0.05$). Furthermore, in the Eddy's hot plate test, oral administration of EEIPL at doses of 400 and 600 mg/kg exhibited potent analgesic effects (3.21 ± 0.29; 4.31 ± 0.64) after 60 minutes, with significant activity ($p < 0.05$), while the 200 mg/kg dose demonstrated significant analgesic effects after 90 minutes. Tramadol (5 mg/kg, i.p.) served as the standard drug and showed significant activity throughout the study period (Mondal et al., 2014).

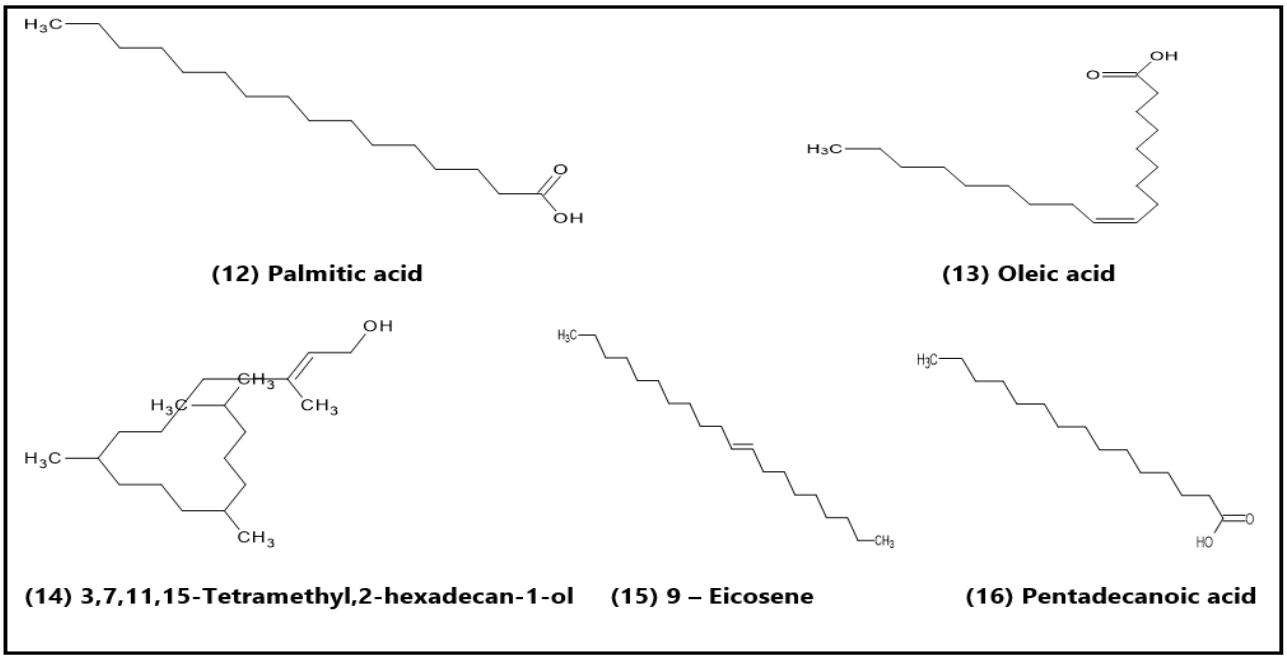

Fig. 4. Structures of fatty acids and its derivatives found in *Ixora parviflora* Vahl.

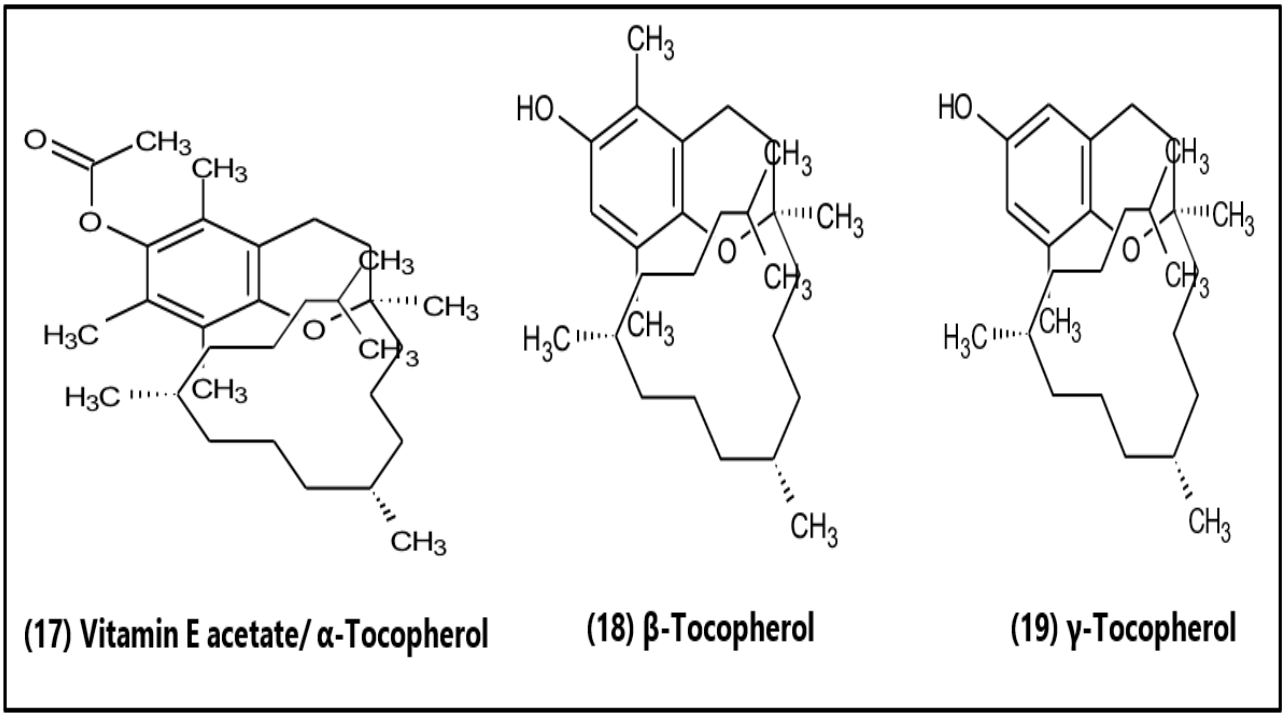

Fig. 5. Structures of vitamins found in *Ixora parviflora* Vahl

6.6. Anti-inflammatory activity

6.6.1. Effects on rats' hind paw edema induced by carrageenan

The ethanolic extract of *I. pavetta* was evaluated for its inhibitory effect on carrageenan-induced edema in the hind paw of rats at various time intervals following carrageenan injection and different doses of the extract. The extract exhibited the highest levels of inhibition at doses of 400 and 600 mg/kg, orally administered with inhibition rates of 25.96% and 33.65%, respectively, after 3 hours of treatment (Table 2). In contrast, the 200 mg/kg dose of the extract did not demonstrate significant activity throughout the study duration. The standard drug, Indomethacin (10 mg/kg, orally administered), showed the highest inhibition, reaching 37.01% after 3 hours of treatment (Mondal et al., 2014).

Table 2
Pharmacological activities of different parts of *Ixora parviflora* Vahl.

Plant part(s)	Place of collection	Extraction method/ solvent	Study method/ parameters observed	Result(s)	References
Antioxidant activity					
Whole plant	Telangana	Soxhlet by methanol	Enzymatic antioxidants level in liver like Glutathione, Catalase,Superoxide dismutase	Notable increase in the enzymatic antioxidants level	Suneeta et al., 2020
Leaves	Taiwan	Methanol	DPPH, ferrous chelating activity, Hydroxyl radical scavenging assay, H2O2 scavengingassay, AAPH-induced erythrocyte hemolysis	Decreases ROS generation in UV exposed human fibroblast (Hs68), powerful neutralizer o free radicals and it is apotential anti-photoaging agent	Wen et al., 2011
Anti-ulcer activity					
Flowers	Marthandum, Tamil Nadu	Cold percolation by using Ethanol	Aspirin induced pylorus ligated rat model	Decreases the gastric acid secretion, free acidity and gastric ulcers , Omeprazole is used as a standard	Srinivas et al., 2011
Antimicrobial activity					
Leaves	Dhaka, Bangladesh	Maceration by Methanol	Agar well diffusion method	Zone of inhibition for Salmonella typhi, Bacillus subtilis, Salmonella paratyphi, Acinetobacter baumannii and Gentamicin is used as a standard	Akter et al., 2015
Hepatoprotective activity					
Leaves	Methanolic extraction	Taiwan	Antioxidant enzymes activity in liver and lipid peroxidation	Increased antioxidant enzyme activity and SOD expression, decreased lipid peroxidation and expression of NADPH oxidase complex	Kan et al., 2013
Whole plant	Telangana	Soxhlet extraction by methanol	Levels of serum biochemical markers and enzymatic antioxidants in liver	Increased enzymatic antioxidants level and total proteins, decreased serum biochemical markers level. Silymarin is used as a standard	Suneeta et al., 2020
Analgesic activity					
Leaves	Andrapradesh	Soxhlet extraction by ethanol	By writhing method induced by Acetic acid	Reduces the writhing and potential inhibition of Formalin noxious stimulation. Aspirin is used as standard.	Mondal et al., 2014
			By eddy's hot plate method	400 and 600 mg/kg, p.o., shows powerful analgesic activity.Tramadol is used as standard.	
Anti-inflammatory activity					
Leaves	Andrapradesh	Soxhlet extraction by ethanol	Carrageenan-induced hind paw edema in rats model	Highest level of inhibition of inflammation at 400 and 600 mg/kg, p.o., and standard drug is Indomethacin.	Mondal et al., 2014

Table 2
Continued

Plant part(s)	Place of collection	Extraction method/ solvent	Study method/ parameters observed	Result(s)	References
Leaves	Andrapradesh	Soxhlet extraction by ethanol	Arachidonic acid-induced hind paw edema in rats model	Inhibitory effect on the development of edema. Here also Indomethacin is a standard drug.	Mondal et al., 2014
Anti-pyretic activity					
Leaves	Andrapradesh	Soxhlet extraction by ethanol	Brewer's yeast induced pyrexia in rats model	Reduction of fever	Mondal et al., 2014
Anti-urolithiatic activity					
Leaves	Andrapradesh	Soxhlet extraction by ethanol	Calcium oxalate crystallization method	Beneficial inhibitory effects on calcium oxalate crystallization	Poojitha et al., 2017

6.6.2. Effects on rats' hind paw edema induced by arachidonic acid

Administered at a dosage of 10 mg/kg, indomethacin serves as a dual inhibitor of arachidonic acid metabolism and demonstrates a significant inhibitory effect on edema development. Similarly, the ethanolic extract of *I. pavetta* markedly inhibited arachidonic acid-induced hind paw edema at doses of 200, 400, and 600 mg/kg (Mondal et al., 2014).

6.7. Anti-pyretic activity

The anti-pyretic effects of the ethanolic extract of *I. pavetta* leaves and the standard drug aspirin were evaluated using a rat model of Brewer's yeast-induced pyrexia. The plant extract demonstrated a reduction in fever induced by yeast starting from the fourth hour of administration at doses of 400 and 600 mg/kg orally, while aspirin began to lower fever from the 1st hour of administration. However, the plant extract at a dose of 200 mg/kg orally did not yield significant results (Table 2) (Mondal et al., 2014).

6.8. Anti-urolithiatic activity

With increasing concentrations of ethanolic extract of *I. pavetta*, the crystallization of calcium oxalate was inhibited in solution, resulting in smaller and fewer particles (Table 2). This property of the extract is advantageous for preventing urinary stone formation by stimulating the kidneys to excrete tiny particles and reducing particle retention in the urinary tract. Therefore, the inhibitory effect of *I. pavetta* extract on calcium oxalate crystallization may be beneficial in the treatment of urolithiasis (Poojitha et al., 2017).

7. Concluding remarks

Ixora parviflora Vahl. is a valuable natural product renowned in traditional medicine for its diverse biological properties, including antimicrobial, anti-ulcer, anti-inflammatory, antioxidant, anti-urolithiatic, analgesic, anti-pyretic and hepatoprotective activities. Different analytic techniques have been employed to delve into the phytochemistry of this plant, revealing the presence of numerous bioactive compounds that are closely associated with its biological functions. All the chemical constituents found in *I. parviflora* Vahl. work synergistically to confer the aforementioned properties. Furthermore, there is a pressing need for future studies to explore the beneficial effects of combining this plant with pharmaceutical drugs and other therapeutic targets.

Data availability

The data used to support the findings of this study are included within the article.

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Author contribution statement

Kaviyarasi M: Phytochemical review, Pharmacological review, writing original draft preparation and writing review; Thenmozhi R: References writing and editing; Vijayabharathi R, Muthusamy P, Radha R: Supervision and emendation.

Abbreviations

ALP: Alkaline phosphatase; **APPH:** 2,2′-Azobis (2-methylpropionamidine) dihydrochloride; **EEIPL:** Ethanolic extract of *I. pavetta* leaves; **IR:** Infrared; *Ixora parviflora* Vahl.: *I. parviflora* Vahl.; **NMR:** Nucleus Magnetic Resonance; **RBCs:** Red blood cells; ROS: Reactive oxygen species; **SGOT:** Serum glutamate oxaloacetate transaminase; **SGPT:** Serum glutamate pyruvate transaminase; **SOD:** Superoxide dismutase; **UV:** Ultraviolet;
WHO: World Health Organization.

Conflict of interest

The authors declare that there is no conflict of interest.

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