

Review Literature of Pharmacological Actions on *Ixora coccinea*

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ABSTRACT

Ixora coccinea, a perennial shrub widely cultivated across tropical and subtropical regions, is recognized for its diverse phytochemical profile and broad spectrum of pharmacological activities. Rich in bioactive constituents such as flavonoids, tannins, saponins, alkaloids, and phenolics, both the leaves and flowers of this plant have been traditionally employed in the treatment of a variety of ailments, including wounds, skin disorders, respiratory conditions, and gastrointestinal issues. Experimental evidence highlights potent antioxidant, anti-inflammatory, analgesic, antimicrobial, gastroprotective, hepatoprotective, antidiabetic, anticancer, wound healing, and anti-arthritic properties attributed predominantly to its phenolic and flavonoid compounds. These pharmacological actions are substantiated by in vitro and in vivo studies demonstrating efficacy comparable to standard drugs in certain models. This review consolidates current findings on the chemical composition and multifaceted therapeutic potential of *Ixora coccinea*, underscoring its value as a promising botanical resource for future drug development and integrative health applications.

Keywords:-Antioxidant, Anti- inflammatory, Analgesic, Antimicrobial, Gastroprotective, Hepatoprotective, Antidiabetic, Anticancer, Wound healing, and Anti-arthritic, *Ixora coccinea*

INTRODUCTION

Ixora coccinea (Rubiaceae), commonly known as Jungle Geranium or Flame of the Woods, is a medicinal shrub widely used in traditional medicine. Recent research has explored its pharmacological properties, validated traditional claims and identified diverse bioactive compounds.

Botanical Description

Ixora coccinea is a dense, multi-branched evergreen shrub that commonly grows 1.2–1.8 m tall but can reach up to 3.7 m.[1,2]

The woody stems support glossy, leathery, oblong to elliptical leaves approximately 5–10 long with entire margins, arranged oppositely or in whorls. [1]

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The flowers are small, tubular, clustered in dense rounded cymes 5–13 cm across, predominantly scarlet but also appearing in orange, pink, yellow, or white cultivars; flowering occurs almost year-round[1,3].

The fruits are globose berries, ripening to red, yellow, or black, typically with a single seed[1,3]

Distribution and Habitat

Ixora coccinea is native to southern India, Bangladesh, and Sri Lanka and is widely cultivated throughout Southeast Asia, including Malaysia, Thailand, Indonesia, the Philippines, Vietnam, Cambodia, and Laos[1,2].

It grows naturally in forest edges, plains, woodlands, and coastal areas up to 600 m elevation¹. Preferring full sun to partial shade and moist, well-drained acidic soils (pH < 6), it is intolerant to alkaline or saline conditions[1,3]

It is extensively planted as an ornamental shrub globally in tropical and subtropical regions[2,3].

Traditional Uses

Different parts of *I. coccinea* have long-standing uses in Ayurvedic and traditional medicine systems[2,3].

The leaves are used topically and internally for treating wounds, skin ulcers, hiccups, nausea, anorexia, sore throat, bronchitis, cough, and asthma[1,2].

Flowers have been employed to manage hypertension, irregular menstruation, female reproductive infections, haemoptysis, and various skin diseases due to their astringent and anti-inflammatory properties [1,3].

Root decoctions address digestive issues such as diarrhea, dysentery, nausea, and anorexia, and powdered roots are applied topically to sores and ulcers [1,2].

Other traditional applications include use as a blood purifier, sedative, antidiarrheal agent, and immunity booster, especially

via leaf juice given to infants [2,3].

Often, the plant is used with others like *Centella asiatica* and cumin in combined therapies [1,2].

Phytochemical Composition

The plant contains diverse bioactive compounds:

- Triterpenoids: Ursolic acid (27.3%), oleanolic acid (20.2%), lupeol (15.1%), the dammarane triterpene ixorene, and β -sitosterol [1,3].
- Essential Oils (from flowers): Geranyl acetate (8.7%), linalyl acetate (6.8%), neryl acetate (6.5%) [3].
- Flavonoids: Quercetin, kaempferol, epicatechin, myricetin, and glycosides are abundant in leaves and flowers[1,3].
- Tannins and Phenolics: Flowers contain ~15.3% tannins, including proanthocyanidins like ixora tannin A-2 and procyanidin A2, responsible for antioxidant and antiulcer effects[1,3].
- Alkaloids: Includes camptothecin, recognized for potent anticancer activity [[1,2].
- Other compounds: Saponins, glycosides, coumarins (scopoletin), anthocyanins, peptides, sterols, quinones, and carbohydrates are present variably^{1,2}.

Quantitative Phytochemical Content of Flower Extract (% w/w)

Constituent	Content (%)
Tannins	15.34
Flavonoids	14.10
Saponins	11.15
Alkaloids	10.80
Phenols	4.36
Glycosides	0.89

These phytochemicals explain the plant's wide pharmacological activities, including antioxidant, anti-inflammatory, antimicrobial, gastroprotective, and wound-healing properties[1,2,3].

MAJOR PHARMACOLOGICAL ACTIONS

1. Antioxidant Activity

- Extracts (especially methanol) of *Ixora coccinea* exhibit significant free radical scavenging abilities, as tested by DPPH and superoxide assays [4,5].
- High phenolic and flavonoid content contribute to its strong antioxidant capacity, which is comparable to standard antioxidants such as ascorbic acid [4,5].
- The plant's extracts can protect against oxidative stress in various biological models[6].

2. Anti-Inflammatory Activity

- Flower and root extracts of *Ixora coccinea* demonstrate notable anti-inflammatory effects in animal models, including carrageenan-induced paw edema [7,8].
- The mechanism involves inhibition of pro-inflammatory mediators like nuclear factor- kappa B (NF-κB), reduction of cytokines (IL-1β, IL-6, IL-8, TGFβ), and interference with inflammatory gene expression [9,5].
- The anti-inflammatory effect is dose-dependent and approaches the effectiveness of standard drugs (e.g., indomethacin) [7,5].

3. Analgesic (Pain-Relieving) Activity

- Methanolic flower extracts show significant analgesic activity, reducing pain responses in models such as acetic acid-induced writhing and the hot plate test in rodents [7,8].
- The action is not related to opioid receptors but rather to inhibition of inflammatory pathways[7].

4. Antimicrobial Activity

- *Ixora coccinea* exerts antibacterial effects against various pathogens, including *Staphylococcus aureus* and *Bacillus subtilis* [6,10].
- Active constituents (flavonoids, phenolics, tannins) disrupt microbial cell walls, inhibit enzymes, and impair nucleic acid synthesis [9,6].
- Both root and flower extracts have demonstrated antimicrobial activity in vitro[6,10]

5. Gastroprotective and Anti-Ulcer Activity

- Extracts protect the gastric mucosa by reducing volume and acidity of gastric secretions and increasing pH[11].
- Significant reduction in ulcer formation (up to 79% in animal models) is observed, likely related to flavonoids, terpenoids, and saponins that provide mucosal cytoprotection and antisecretory action[11].

6. Hepatoprotective Activity

- Hepatoprotective effects are seen in rats with liver injuries induced by drugs (e.g., isoniazid, rifampicin) [11].
- Treatment with *Ixora coccinea* extract improves liver weight, serum liver markers, reduces oxidative stress and inflammatory cytokines, and restores liver histology. [11]

7. Antidiabetic Activity

- Flower extracts inhibit alpha-amylase, suggesting a potential for glucose regulation and diabetes management[4].
- The effect, while not as strong as standard drugs, shows promise for further exploration.

8. Anticancer/Cytotoxic Activity

- Intraperitoneal administration of the flower extract reduces tumor growth

and enhances survival time in mice with certain cancers. [12]

- The extract displays cytotoxicity in vitro against tumor cell lines while sparing normal lymphocytes, possibly by inhibiting DNA synthesis and replication [12]

9. Wound Healing

- Methanol extracts promote wound healing by accelerating wound contraction and collagen production, increasing hydroxyproline content, and upregulating growth factors such as bFGF and collagen III in

tissue[13].

- Enhanced proliferation and migration of fibroblasts contribute to faster healing in animal models. [13]

10. Other Activities

- Anti-arthritis and anxiolytic effects, with modulation of GABA-chloride channels, have been reported in preliminary studies[5].
- Traditional use also includes applications as an astringent, antiseptic, blood purifier, sedative, and treatment for a range of disorders [14,15].

Summary

Table 1:- Pharmacological Actions of *Ixora coccinea*

Action	Experimental Evidence	Major Bioactive Compounds	References
Antioxidant	DPPH, Superoxide, Reducing power	Phenolics, Flavonoids	4,5,6
Anti-inflammatory	Carrageenan paw edema, models	Flavonoids, Tannins, Phenolic acids	9,7,5,8
Analgesic	Writhing, Hot plate (rodents)	Flavonoids, Glycosides, Tannins	7,8
Antimicrobial	In vitro bacterial inhibition	Flavonoids, Phenolics, Saponins	9,6,10
Gastroprotective/Antiulcer	Acid suppression, Ulcer models	Flavonoids, Terpenoids, Saponins	11
Hepatoprotective	Rat liver injury models	Polyphenols, Terpenoids, Saponins	11
Antidiabetic	Alpha-amylase inhibition	Flavonoids	4
Anticancer/Cytotoxic	In vivo & in vitro tumor models	Not fully characterized, Phenolics, Flavonoids	12
Wound Healing	Excision model, collagen synthesis	Methanol extracts (fibroblast growth factors)	13
Anti-arthritis/Anxiolytic	Animal models	Flavonoids, GABA modulators	11

FUTURE RESEARCH DIRECTIONS

Despite promising preclinical data, *Ixora coccinea* remains underexplored in clinical contexts. Areas ripe for further investigation include detailed pharmacokinetics, standardized extract

development, comprehensive toxicological profiles, and controlled human trials. Understanding its molecular mechanisms more thoroughly could unlock new therapeutic applications.

CONCLUSION

Ixora coccinea exhibits a broad range of pharmacological actions, with significant antioxidant, anti-inflammatory, antimicrobial, analgesic, gastroprotective, hepatoprotective, antidiabetic, anticancer, and wound-healing properties. Most pharmacological effects are attributed to the presence of phenolics, flavonoids, and other secondary metabolites. Continued research is warranted to further elucidate individual active compounds and their mechanisms, as well as to confirm safety and efficacy in clinical settings.

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