IJMPR 2025, 9(2), 18-21

International Journal of Modern Pharmaceutical Research

www.ijmpronline.com

ISSN: 2319-5878
IJMPR
Research Article

SJIF Impact Factor: 6.669

PHYTOCHEMICAL SCREENING AND TOXICITY TEST OF IXORA COCCINEA OF SANGA-SANGA, BONGAO, TAWI-TAWI, PHILIPPINES

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Article Received on: 04/12/2024
Article Revised on: 24/12/2024
Article Accepted on: 13/01/2025

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ABSTRACT

Phytochemical screening of terrestrial plant extracts provides fundamental data on their medicinal properties, identifying potential lead compounds for pharmaceutical development and elucidating chemical composition. Variations in flower extracts and other applications were observed. *Ixora coccinea's* bioactive compounds were identified and evaluated for cytotoxicity, revealing potential medicinal applications. Phytochemical and proximate analyses were conducted on *Ixora coccinea* flowers using standard methods on a dry basis. The results revealed methanolic extracts possessed various active secondary metabolites, including alkaloids, flavonoids, glycosides, phenolics and tannins, along with notable bioactive potential advantageous for future pharmaceutical applications. Cytotoxicity tests indicated an LC50 value of 1519.51 ppm, suggesting non-toxic properties. These findings suggest Ixora coccinea may serve as a feed source, underscoring the importance of conserving and exploring Philippine plant species bioactive potential.

KEYWORDS: *Ixora Coccinea*, Phytochemical Screening, Cytotoxicity test, Bioactive Compounds, Medicinal plants.

INTRODUCTION

The Philippines, known globally for its distinct island biodiversity, offers a prime opportunity to explore evolutionary processes. Despite this, many Philippine plant species remain understudied. This research delves into the evolutionary origins and geographic connections of *Ixora Coccinea* species native to the Philippines (Banag et al., 2017).

Ixora coccinea, a vibrant Southeast Asian native shrub abundantly found in Tawi-Tawi, Philippines, showcases exceptional characteristics. This evergreen flowering shrub boasts a dense, bushy, and rounded growth habit, typically reaching 4-6 feet in height, with potential growth up to 12 feet. Its attractive features include 4-inch long, glossy dark green leaves and stunning 4-petaled red flowers blooming in summer, arranged in 5-inch wide clusters. The shrub yields edible, dark purple to black fruits when ripe. For optimal growth, Ixora coccinea requires full sun, moist acidic soils rich in organic matter, and partial shade tolerance. Notably, its small tubular flowers bloom almost year-round (Baliga and Kurian, 2012).

Ixora coccinea, a versatile medicinal plant, boasts remarkable wound-healing and anticancer properties due to its rich composition of flavonoids, polyphenols and alkaloids. Traditionally used to treat various chronic conditions, including ulcers, inflammation, bronchitis, anemia, diarrhea and skin infections, its efficacy is well-established. Phytochemical analysis confirms the presence of bioactive compounds like tannins, saponins, glycosides and phenols, contributing to its antibacterial, anti-inflammatory and antioxidant properties.

These compounds enhance blood clotting, fight infections and promote epithelialization, facilitating rapid wound healing. Research underscores *Ixora coccinea's* potential as a natural remedy for combating diseases. Its antioxidant properties protect against cell damage, while anti-inflammatory properties alleviate symptoms associated with chronic conditions. Furthermore, its antimicrobial activity inhibits the growth of pathogens, making it effective against microbial infections. With its multifaceted benefits, Ixora coccinea warrants further investigation for its therapeutic potential (Chandrasekhar et al., 2024; Ghosh et al., 2023).

MATERIALS AND DATA COLLECTION

Fresh flowers for this study were collected from Yusop Dais, Sanga-Sanga, Bongao, Tawi-Tawi, Philippines (5.0446°N, 119.7448°E, elevation 7.8m) on August 24, 2024. Sanga-Sanga, a barangay in Bongao municipality, has a population of 4,548 (2020 Census), comprising 3.92% of Bongao's total population. Phytochemical analysis adhered to Harborne's 1973 standard procedures.

Cytotoxicity assessment utilized the brine shrimp lethality test (BSLT), a conventional method for preliminary evaluation. This research provides valuable insights into the medicinal properties of these flowers, warranting further investigation into their therapeutic potential.

RESULTS AND DISCUSSION

Wagner's test detected alkaloids in the plant extract, indicated by a light brown to red precipitate. Alkaloids, naturally occurring compounds containing nitrogen, exhibit diverse biological activities, including antioxidant, anti-inflammatory, anticancer, antimicrobial and antiparasitic effects (Rajput et al., 2022; Borsoi, F. T., 2024). Traditionally, this plant treats colic, ulcers, indigestion, headaches and stomachaches, and serves as an anti-inflammatory, antidiarrheal, antiviral and anticancer agent.

Pharmacological studies confirm its antioxidant, antibacterial, anti-asthmatic, antinociceptive, anthelmintic, cytotoxic, anti-diabetic and anti-hyperlipidemic activities. These findings validate the plant's ethnomedicinal uses, highlighting its potential as a natural remedy for various ailments (Permalsamy Naidu et al., 2022).

Flavonoids were identified in plant extracts by adding sodium hydroxide, which initially produced a rich yellow color that turned colorless with diluted hydrochloric acid. These compounds, responsible for yellow, red, or blue plant pigmentation, are renowned for antioxidant properties, protecting against microbes and insects with low toxicity (Rauha et al., 2000). Flavonoids combat cardiovascular diseases, ulcers, viruses, inflammation, osteoporosis, diarrhea and arthritis (Patel, 2008). They neutralize harmful free radicals, mitigating disease-causing effects.

Flavonoids boast medicinal benefits, including anticancer, antioxidant, anti-inflammatory and antiviral properties, alongside neuroprotective and cardio-protective effects (Asad Ullah et al., 2020). Their therapeutic potential stems from effectively addressing various health issues while exhibiting low toxicity. Overall, flavonoids' antioxidant capabilities and broad-spectrum health benefits underscore their significance in pharmacological applications. Further research could fully harness their therapeutic potential.

The ferric chloride test confirmed the presence of phenolics in the plant, indicated by a red-brown precipitate. Phenolics play various roles, including pathogen protection, UV ray shielding and pigmentation (Damle & Sharon, 2017). Recent studies highlight their antioxidant and antimicrobial properties, exhibiting preventive effects against infectious diseases, inflammation and allergies (Ozcan et al., 2014).

Pharmacological investigations reveal the plant's antioxidative, antibacterial, gastroprotective, hepatoprotective, antidiarrhoeal, antinociceptive, antimutagenic, antineoplastic and chemopreventive effects, validating its ethnomedicinal uses (Baliga et al., 2012). This review synthesizes the plant's traditional applications, chemical composition and evidence-based pharmacological findings. The multifaceted benefits of phenolics underscore their therapeutic potential, warranting further exploration.

The ferric chloride test confirmed the presence of tannins in *Ixora coccinea* leaves and flowers from East Calcutta Wetlands, indicated by a blue-black or greenish-black precipitate. These samples showed higher antioxidant, flavonoid and tannin concentrations than institutional samples (Banerjee et al., 2011). Tannins, complex phenolic compounds, reduce nutrient bioavailability but offer numerous health benefits, including antioxidant, anticancer, anti-allergic, anti-inflammatory, anti-helminthic and antimicrobial activities (Sharma et al., 2021).

As potent antioxidants, plant tannins—hydrolysable and condensed—abound in medicinal plants, foods and edible fruits (Kumari & Jain, 2012). Phenolic compounds and flavonoids represent a unique category of phytochemicals, boasting vast health benefits. Their therapeutic potential stems from effectively addressing various health issues, making them valuable for pharmacological applications. Further research could fully harness their benefits.

The Keller-Kiliani test revealed the presence of cardiac glycosides in *Ixora coccinea* flowers, indicated by a green-blue color. Biochemical screening confirmed glycoside presence. Notably, the aqueous extract efficiently synthesizes silver nanoparticles (Nalvolthula et al., 2014).

Glycosides offer substantial health benefits, low toxicity, and bioactivity, making them suitable medicinal and nutraceutical agents (Yang et al., 2018). As water-soluble flavonoid pigments, glycosides exhibit antioxidative, anti-inflammatory, antimicrobial, antidiabetic, antiobesity, cardiovascular protective, neuroprotective and anticancer properties (Chen et al., 2019). They enhance cardiac output and contraction rate by modulating sodium-potassium ATPase pumps, treating heart failure and arrhythmias (Jing Fu, 2023). Additionally, cardiac glycosides show promise in combating autoimmune diseases (Škubník J., 2021). Their multifaceted benefits underscore their therapeutic potential and value in pharmaceutical and nutraceutical applications. Further research may expand their clinical utility.

RESULTS AND DISCUSSION

Phytochemical characterization and toxicity evaluation of *Ixora coccinea's* methanol extract revealed its

bioactivity and cytotoxicity. The Brine Shrimp Lethality Test (BSLT) method demonstrated the extract's safety with a Lethal Concentration 50 (LC50) value of 1519.51 ppm, categorizing it as non-toxic (Pohan et al., 2023). Similarly, Bharathy et al. (2024) reported a dose-dependent effect with an LC50 value of 82.4 µg/mL, indicating safety for clinical use, even during pregnancy. Toxicity assessments employing varying solvents (acetone, methanol, and aqueous) showed differing mortality rates over 72 hours. The acetone extract exhibited 100% mortality (LC50: 0.8 mg/ml), methanol extract showed 51.7% mortality (LC50: 4.95 mg/ml), and aqueous extract displayed 0% activity (Okwubie & Ajogwu, 2021). These findings suggest the acetone root extract warrants further investigation to isolate active principles with larvicidal activity. Variations in extraction methods and solvents likely contributed to differing results (Harborne, 1973), highlighting the importance of standardized protocols for Ixora coccinea's pharmacological applications.

CONCLUSION

Ixora coccinea flower extracts boast diverse bioactive compounds, encompassing alkaloids, flavonoids, phenolics, tannins, saponins, triterpenoids, steroids and glycosides. These metabolites exhibit medicinal properties, providing antioxidant, anti-inflammatory, antimicrobial and antiviral benefits. They facilitate wound healing by promoting blood clotting, combating infection and enhancing epithelialization.

Therapeutically, *Ixora coccinea* may effectively manage chronic conditions: ulcers, bronchitis, anemia, diarrhea, microbial infections and skin infections. Its pharmacological potential stems from its capacity to address various health issues, making it a valuable source of natural phytochemicals. Further research is warranted to isolate, characterize and evaluate the bioactivity of these compounds, unlocking their therapeutic applications.

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