



REVIEW ARTICLE

Phytopharmacological Review of *Hamelia Patens*

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ABSTRACT

Hamelia patens (Rubiaceae) is an ornamental plant grown almost worldwide in warm, moist areas. Firebush is used in herbal medicine to treat athlete's foot, skin lesions and insect bites, nervous shock, inflammation, rheumatism, headache, asthma, and dysentery. The aim of this review is to comprehensively outline the botanical description, phytochemistry, pharmacology of *Hamelia patens*. Peer-reviewed articles on *Hamelia patens* were acquired via an electronic search of the major scientific databases (Pubmed, Google Scholar, and ScienceDirect). Data were collected from scientific journals, thesis and books. *Hamelia patens* Jacq. [Syn. *H. erecta* Jacq. (Rubiaceae)] is a large evergreen shrub, indigenous to America. It was introduced in India as an ornamental plant and grown in gardens. It is a perennial bush, and grows in full sun and in shade. *Hamelia patens* contain oxindole alkaloids like isopteropodine, rumberine, palmirine and mitrajavine. It also contain flavonoids such as kaempferol-3-*O*-rutinoside, (-) epicatechine 5,7,2',5'-tetrahydroxyflavanone 7-*O*- α -L-rhamnopyranoside, 5,7,2',5'-tetrahydroxyflavanone 7-*D*-glucopyranoside, narirutin and rosmarinic acid. Other chemical constituents are ephedrine, carbohydrate, proteins, tannins. *Hamelia* shows anthelmintic, antimicrobial, cytotoxic activity, wound healing activity, antioxidant activity, anti-bacterial activity and anti-inflammatory activity. *Hamelia patens* are traditionally used for the treatment of a wide range of ailments. The primary as well as secondary metabolites isolated from different parts of *Hamelia patens* including flavonoids, alkaloids, tannins, carbohydrate and proteins. Pharmacological investigations have validated different uses of *Hamelia patens*.

KEYWORDS

Hamelia Patens, Flavonoids, Oxindole Alkaloids, Wound Healing Activity

INTRODUCTION

Plants have been utilised as a natural source of medicinal compounds since thousands of years. Human is using numerous plants and plant derived products to cures and relief from various physical and mental illness. These plants are used in traditional Chinese, Ayurveda, Siddha, Unani and Tibetan medicines.

Ancient literature such as Rigveda, Yajurveda, Atharvaveda, Charak Samhita and Sushrut Samhita also describes the use of plants for the treatment of various health problems¹. All over the world the herbal medicine acts as the representative of the most important fields of traditional medicine. The study on the medicinal plants is essential to promote the proper use of herbal medicine in order to determine their potential as a source for the new drugs². According to the WHO, the plant based traditional medicine systems continues to play an essential role in health care, with about 80% of

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the world's inhabitants relying mainly on traditional medicines for their primary health care³.

Taxonomical Description

Synonyms: *Hamelia erecta* Jacq., *Hamelia coccinea*, *Hamelia pedicellata* Wernh, *Hamelia latifolia* Reichb. ex DC.

Common Names

Hindi: *Hamelia*

English: Scarlet bush, Fire bush, Hummingbird bush⁴

Kingdom: Plantae

Subkingdom: Tracheobionta

Subdivision: Spermatophyta

Division: Magnoliophyta

Class: Magnoliopsida

Subclass: Asteridae

Order: Rubiales

Family: Rubiaceae

Genus: *Hamelia* Jacq.

Species: *Hamelia patens* Jacq.^{5,6}

Plant Morphology

Hamelia patens Jacq. is bush or small tree, 1.4-3.0 m but sometimes reaches 7 m in height tall, trees produce flowers and fruits throughout the year. It grows as a tree in the Atlantic tropical lowland of Costa Rica. The fruits are also eaten by birds which disburse the seeds. Plants may have single or multiple stems. The twigs are orange to purple. Leaves are opposite or grouped in threes or fours, and finely hairy to glabrous. The leaves have petioles 1 to 3.5 cm long and blades that are mostly ovate-elliptic to obovate-elliptic with an acute or acuminate tip. The lateral and especially the mid veins are red or pink. In temperate areas, as the temperatures turn cool in the fall, the foliage turns to a brilliant red, hence the common name. The inflorescence is terminal, a modified dichasium with flowers that are tubular, 12 to 22 mm long, and orange to red in color. The fruit is a berry, spherical to elliptical,

7 to 10 mm long, turning red and then black at maturity. The fruit is edible.⁷⁻⁸ The seeds are orange brown, 0.6 to 0.9 mm long. Firebush has a tap and lateral root system with abundant fine roots.⁹ Stem bark is gray and smooth and the inner bark is light green (Figure 1). *Hamelia patens* should be planted in full sun or part shade in well drained soil beginning in mid-May and on into the summer. It can tolerate many types of soils from heavy clays to high alkaline but mostly prefers loamy or clayey soil, Propagation is by soft wood cuttings in spring or by seed.¹⁰⁻¹²



Figure 1: Plant of *Hamelia patens*

Phytochemical Investigation

Oxindole Alkaloids

Borges et al. (1779) isolated two new oxindole alkaloids of the heteroyohimbane type from aerial part of *Hamelia patens* Jacq. Their structures correspond to that of isopteropodine with -OH and -OCH₃ groups at C-10.

The aerial part of *Hamelia Patens* Jacq. was refluxed in ethanol, yielding a crude extract of alkaloids. Chromatography of this extract on Kieselgel 60, using varying proportions of benzene and ethyl acetate, gave in the medium polarity fractions a crystalline product, the new oxindole alkaloid palmirine and rumberine.¹³

Flavanone Glycoside

Aquino et al. (1990), isolated flavanone glycoside from methanol extract of aerial parts of *Hamelia patens* in the form of 5,7,2',5'-tetrahydroxyflavanone 7-O-a-L-rhamno-pyranoside, 5,7,2',5'-tetrahydroxy-flavanone 7-

D-glucopyranoside, narirutin and rosmarinic acid (Figure 2). Separation of the components of a methanolic extract of *H. patens*, by sequential Sephadex LH-20 column chromatography and semi-preparative RP HPLC. The structure was confirmed ^1H , ^{13}C , DEPT NMR and FABMS.

5,7,2',5'-tetrahydroxyflavanone 7-0-a-L-rhamnopyranoside & 5,7,2',5'-tetrahydroxyflavanone- 7-D-glucopyranoside, a new flavanone glycoside isolated for the first time from a natural source.¹⁴

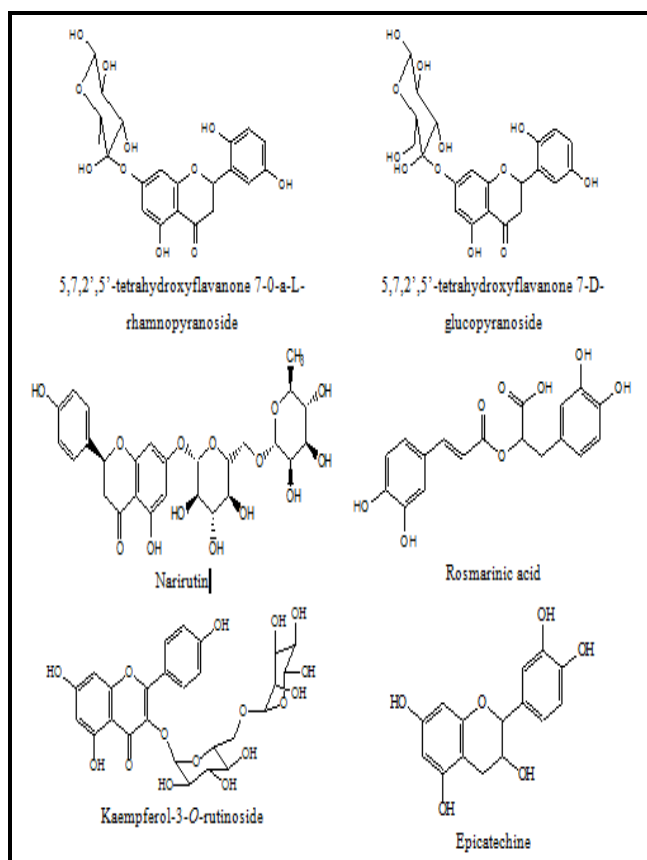


Figure 2: Flavonoids present in *Hamelia patens*

Ephedrine

Chaudhuri and Thakur (1991) isolated Ephedrine from Methanol extract of air dried leaves and twigs of *H. patens* in the form of 1-ephedrine hydrochloride. The identity of 1-ephedrine hydrochloride was established by spectroscopic methods (UV, IR, UID, ^1H - and ^{13}C -NMR, and mass) and by comparison with an authentic sample. The isolated yield of 1-ephedrine on dry plant weight basis was 0.05% .¹⁵

Alkaloids and Flavonoids with Leishmanicidal Activity

Suarez et al. (2008) isolated from four alkaloids the ethanol extract of leaves viz., isopteropodine, palmirine, rumberine and mitrajavine (Figure 3) and evaluated *in vitro* for antileishmanial activity. Palmirine one of the main alkaloids, showed the highest leishmanicidal activity with $\text{IC}_{50} = 56 \mu\text{M}$, the alkaloid mitrajavine by using promastigote form of the parasite and the two flavonoids isolated from the ethyl acetate extract of leaves viz., kaempferol-3-*O*-rutinoside and (-) epicatechine (Figure 2) are reported for the first time in this.¹⁶

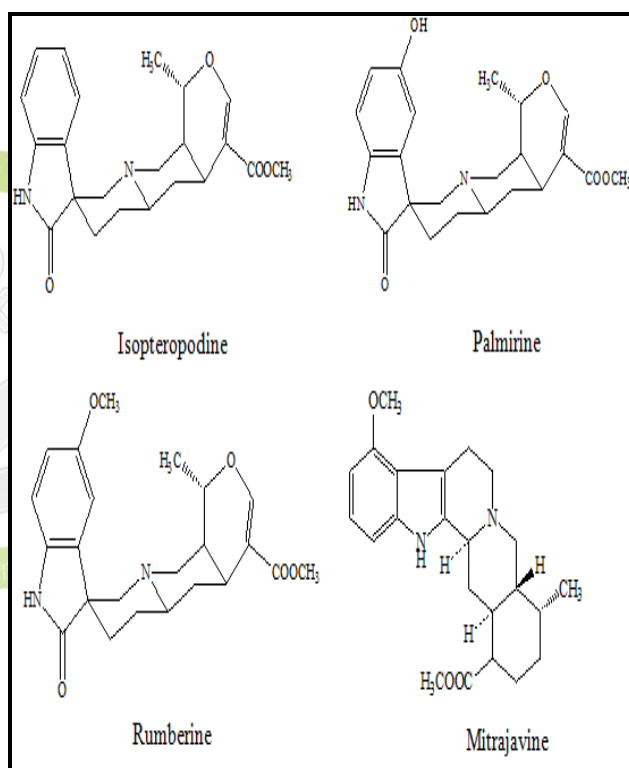


Figure 3: Alkaloids present in *Hamelia patens*

Starch, Proteins, Lipid and Phenol

Khandelwal et al. (2011) quantitative estimated starch, proteins, lipid and phenol in stems and roots of *Hamelia patens*. Starch present in Leaves, stem and bark of *Hamelia patens* is 37.5 ± 0.41 , 28.6 ± 1.12 , 30.4 ± 1.51 mg/ g, Soluble sugars 48.2 ± 0.64 , 44.5 ± 0.89 , 52.6 ± 1.14 mg/ g, Proteins 87.8 ± 0.79 , 34.5 ± 1.14 , 94.2 ± 1.41 , **Lipid** 28.5 ± 0.77 , 2.6 ± 0.41 , 5.7 ± 1.12 , **Phenol** 104.6 ± 1.12 , 50.7 ± 1.41 , 47.2 ± 0.89 respectively.¹⁷

Pharmacological Activity

Anti-inflammatory Activity

Sosa et al. (2002) screened Hexane, chloroform and methanol extracts of *Hamelia patens* leaves for topical anti-inflammatory activity against the Croton oil- induced ear oedema in mice. Most of the extracts induced a dose-dependent oedema reduction. The chloroform extract showed good activity than Hexane and methanol extracts of *Hamelia patens* leaves. The ID₅₀ value for chloroform extract and indomethacin was 255µg/cm², 93 µg/cm² respectively.¹⁸

Anti-Bacterial Activity

Camporese et al. (2003) evaluated Hexane (3.1%) Chloroform (3.5%), and Methanol (7.7%) extract of *Hamelia patens* (Rubiaceae) leaves for anti-bacterial properties. Activity was tested against standard strains of *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853, *Staphylococcus aureus* ATCC 25923 and *Enterococcus faecalis* ATCC 29212. Hexane extract inhibited the growth of *Escherichia coli* ATCC 25922 only.¹⁹

Antioxidant Activity

Ramos et al. (2003), evaluated antioxidant activity of hydroalcoholic extract of *Hamelia patens* Leaves by using 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical assay. The IC₅₀ was found to be 116µg/ml hydroalcoholic extract of *Hamelia patens*.²⁰

Wound Healing Activity

Gomez-Beloz et al. (2003) evaluated wound healing activity of Ethanol extract of aerial parts of *Hamelia patens*. *Hamelia patens* Jacq. (Rubiaceae) has received little attention in the laboratory for its wound healing ability even though it is commonly used as a treatment for wounds throughout Central America.

A double incision wound healing bioassay was carried out with a crude extract of *Hamelia patens* collected from El Salvador. *Hamelia patens* does increase breaking strength of wounds significantly more than the control group.²¹

Contraction of Myometrium

Reyes-Chilpa et al. (2004) determined methanol extract of *Hamelia patens* leaves relaxed in a concentration-dependent manner the high KCl-induced contraction in rat myometrium.²²

Cytotoxic Activity

Mena-Rejon et al. (2009) performed Cytotoxicity assay of methanolic extract of leaves, stem bark and root bark were performed by using the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT) assay on four cancer cell lines; nasopharynx carcinoma (KB), laryngeal carcinoma (Hep-2), cervix adenocarcinoma (HeLa), and cervix squamous carcinoma cells (SiHa) and one normal cell line canine kidney (MDCK). The root bark extract of *Hamelia patens* exhibited cytotoxic activity on HeLa cells with a Cytotoxic concentration 50 (CC₅₀) of 13µg/mL and selectivity index of 13.3, higher than docetaxel.²³

Anthelmintic and Antimicrobial Activity

Khandelwal et al. (2012) evaluated the anthelmintic and antimicrobial activity of ethanolic extract of different parts (Leaf, stem and root) of *Hamelia patens* Jacq.

Anthelmintic activity of this ethanolic extract of different parts (Leaf, stem and root) of *Hamelia patens* was evaluated on Indian adult earthworms, *Pheretima posthuma*, and exhibited a dose dependent inhibition of spontaneous motility (paralysis), and evoked responses to pin-prick, and the effects were comparable with that of piperazine citrate.

The extracts were also assayed for antimicrobial activity against some fungal spp. viz. *Aspergillus flavus*, *A. fumigatus* and *Penicillium sp.* Antimicrobial activity was conducted by the disc diffusion method. The extract showed varies levels of antimicrobial activity on different test fungi.²⁴

CONCLUSION

Hamelia patens is traditionally used for the treatment of a wide range of ailments. The primary as well as secondary metabolites isolated from different parts of *Hamelia patens* including flavonoids, alkaloids, tannins, carbohydrate and

proteins. Pharmacological investigations have validated different uses of *Hamelia patens*.

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