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Bougainvillea glabra: A Brief Review on Phytochemistry, and Pharmacology

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ABSTRACT

Ayurveda is a traditional system of medicine in India that places an emphasis on the healing properties of plants. One of the plants that is said to be beneficial in Ayurvedic practice is the Bougainvillea glabra. Bougainvillea, has been studied for its purported medical benefits. These include its ability to fight cancer, diabetes, hepatotoxicity, inflammation, hyperlipidemia, bacteria, and ulcers. Therapeutic effects were said to originate from the plant's phytoconstituents, which include alkaloids, flavonoids, glycosides, phenolics, phlobotannins, quinones, saponins, tannins, and terpenoids. Bougainvinones, pinitol, quercetagetin, quercetin, and terpinolene are also significant components that contribute to the healing effects. Databases like Google Scholar, Science Direct, PubMed, Sci Finder, and Scopus were scoured for articles detailing these newly discovered B. glabra traits. This article provides an assessment of the evidence for and against using B. glabra as a traditional medicinal herb. Keywords- Phytoconstituents, Bougainvillea glabra, Ayurvedic practice, traditional medicinal herb, Therapeutic effects.

Keywords: Bougainvillea Glabra; Phenolic; Phytochemicals; hepatotoxicity.

INTRODUCTION

Herbal remedies, also known as natural goods and including things like herbs, animals, and microbes, are the oldest kind of health care practiced everywhere in the world. They are used for the treatment and management of illnesses.[1] Traditional medicinal plants are experiencing a period of rapid expansion and are currently being utilized all over the world in a wide variety of therapeutic applications, such as the following: African traditional medicine based immune boosters and infectious diseases; Chinese traditional drug plants for advancement of memory and mental function; Indian traditional medicinal plants with antidiabetic potentials; Korean traditional medicinal plants utilized for stroke remedy; Thai traditional medicinal plants with antimalarial activities; and Thai traditional medicinal plants with antimalarial activities.[2,3] The purpose of this review is to provide up-to-date information on the characteristics of Bougainvillea plants which is one of the plants being researched for a variety of potential health advantages.[4,5]

Bougainvilleas Morphology

Its nickname " Paper Flower." Bougainvilleas are usually purple or magenta, but can be white ororange (Figure 1).[6,7] Woody perennial vine with multi-trunked, clumping stems that spread 2-4 m. It climbs using arching canes with tough curved thorns. Mid-green stems becoming drab green-brown during growth. Pale, corky bark. 5-10 cm long, 2-6 cm broad. forms ranging from oblong to circular. The leaves are a dark green colour, have a leathery feel, and are hairy on the underside. In the axils of the leaves, a trio of blossoms appears. They have a creamy colour, are rather slim, have hairy tubes, and are encircled with flashy. [8,9] The ruffled, somewhat big, egg- shaped bracts come in a rainbow of hues, from pink and red to magenta and purple. The fruit is a narrow achene with five lobes, measuring between 0.2 and 0.8 centimetres in length.[10,11] It's not particularly eye-catching, and its dry, hard fruit cover makes it difficult to see.[12,13]

Fig 1: Bougainvillea Plants

Taxonomy

B. spectabilis' taxonomy includes the Kingdom (Plantae), Subkingdom (Viridiplantae), Infrakingdom (Streptophyta), Superdivision (Embryophyta), Division (Tracheophyta), Subdivision (Spermatophytina), Class (Magnoliopsida), Superorder (Caryophyllanae), Order (Caryophyllales), Family ((B. spectabilis) . Louis Antoine de Bougainvillea, a French navigator, discovered this species in Brazil in 1786. B. berberidifolia, B. buttiana, B. campanulata, B. glabra, B. herzogiana, B. infesta, B. lehmanniana, B. lehmannii, B. malmeana, B. modesta, B. pachyphylla, B. peruviana, B. pomacea, B.praecox, B. spectabilis, B. spinosa, B.[14,15,16]

Nomenclature

The B. spectabilis is a plant that is indigenous to South America and may be found growing in climates that are warm and tropical. The common names for B. spectabilis include paper flower in English, baganbilas in Bengali, mao bao jin and ye zi hua in Chinese, bougainvillier in French, booganbel in Hindi, buganvillea in Italian, bunga kertas in Indonesian, felila in Japanese, bouganvila in Konkani, buginvila in Malaysia, cherei in Manipuri, buginvil (Vietnamese) .[17,18]

Components of the Plant's Phytochemistry

The stem, flowers, and leaves of B. spectabilis14 were subjected to phytochemical testing, and the results showed that the plant contained alkaloids, flavonoids, furanoids, glycosides, phenols, phlobotannins, quinones, saponins, steroids, tannins, and terpenoids. These compounds were extracted from the plant. Other active components include bougainvinones and peltogynoids, essential oils such as methyl salicylate, terpinolene, and -(E)-ionone16, pinitol, -sitosterol, quercetin, and quercetin-3-O-rutinoside, and pinitol and -sitosterol. Tannins (27.64 percent), saponins (14.08 percent), glycosides (11.49 percent), flavonoids (10.05 percent), alkaloids (4.10 percent), phytate (49.27 percent), and oxalate (27.65 percent) contents were found to be present in the B. spectabilis leaf extract, as revealed by the phytochemical constituents of the extract.[19,20,21].

PHARMACOLOGICAL ACTIVITY OF PLANT

Antibacterial Property

Umamaheswari et al. tested B. spectabilis leaf extracts for antibacterial activity. Staphycococcus aureus, Bacillus subtilis, Streptococcus faecalis, Micrococcus luteus, Escherichia coli, Pseudomonas aeruginosa, Salmonella typhii, Klebsiella pneumoniae, Proteus vulgaris, Serratia marcescens, Shigella flexneri, and Vibrio cholerae were studied. Diethyl ether and aqueous extracts had smaller inhibitory zones than ethanolic, methanolic, chloroform, and ethyl acetate extracts. They screened for amino acids, proteins, anthroquinones, saponins, triterpenoids, flavonoids, carbohydrates, alkaloids, phytosterols, glycosidal sugars, tannins, phenols, and furanoids. These compounds in plant leaf extracts may be antimicrobial.[22,23,24] Kumara Swamy et al. tested B. spectabilis floral extracts for antibacterial activity. Bacillus, Klebsiella, Proteus, Pseudomonas were studied. Ethanolic and aqueous extracts had bigger inhibitory zones than chloroform and ethyl acetate. Alkaloids, flavonoids, phlobatannins, and terpenoids were screened for qualitatively.[25,26,27] Dhankhar et al. tested the antibacterial activity of leaf extracts (water, methanol, acetone, chloroform, petroleum ether).[28,29] Escherichia coli, S. aureus, K. pneumoniae, and V. cholerae were studied. Methanolic extract inhibited K. pneumoniae most (13.5 mm).[30,31]. Hajare et al. tested B. spectabilis leaf extracts for antibacterial activity. Escherichia coli and Micrococcus aureus were studied. They found that ethanolic and acetone extracts are superior than aqueous extracts as first aid disinfectants.[32,33]

Antihyperlipidemic Activity

Adebayo et al. suggested B. spectabilis leaf reduced serum cholesterol. Rats received 50, 100, and 200 mg/kg/day of B. spectabilis ethanolic extract for 7 days. Plant extract lowered cholesterol and triglyceride.[34,35]

Saikia and Lama et.al observed that B. spectabilis leaf lowered serum lipid profile in high-fat-fed rats and compared it to simvastatin. Rats received 100 or 200 mg/kg/day of B. spectabilis methanolic extract for 8 weeks.

The plant extract reduced total cholesterol, triglyceride, LDL, and VLDL. It also increased HDL[36,37].

Anti-diabetic Activity

Bhat et al. found that B. spectabilis leaf lowered intestinal glucosidase activity in diabetic mice. Mice were treated intraperitoneally with 100 g of B. spectabilis extracts for 21 days. Plant extracts increased glucose-6-phosphate dehydrogenase activity and muscle glycogen. Bhat et al. observed B. spectabilis extracts regenerate insulin-producing cells and boost plasma insulin and c-peptide levels.[38,39,40] Jawla et al.26 studied the stem bark of B. spectabilis in alloxan-induced diabetic rats. Rats received 100, 250, and 500 mg/kg/day of B. spectabilis ethanolic extract for 7 days. Stem bark extract was 22.2% more hypoglycemic than glibenclamide. Jawla et al.27 discovered an antidiabetic from B. spectabilis stem bark. Pinitol, -sitosterol, quercetin, and quercetin-3-O—L-rhamnopyranoside.[41,42,43]

Anti-fertility Activity

Mishra et al. tested 800 mg/kg/day of B. spectabilis leaves on male and female Swiss albino mice for 30 days. This plant can reduce caudal epididymal sperm count from 5.05x106 to 0.65x106 per ml (87.13 percent). This plant treatment reduced seminiferous tubule size, germinal epithelial cell thickness, and leydig interstitial cell hypertrophy. Tubule lumens were sperm-free. In females, it interrupted the estrous cycle, prolonging metaestrus from 10.6 to 25.0 hours. Metaestrus has increased 145.28%, estrus 75.44%, and diestrus 11.43%. Testosterone and oestrogen levels fell.[44,45,46] Hembrom et al. tested 800 mg/kg/day of B. spectabilis leaves on male Swiss albino mice for 50 days. This plant increased anodic protein concentration in mice cauda epididymis seminal plasma (3.74 mg/ml) compared to the control group (2.37 mg/ml). This elevation in anodic protein provides negative charges to sperm membranes, inhibiting capacitation and fertilization.[47,48] This plant also increases LDH M-isozymes from 3.31 to 5.68 units/ml/hr. It suggests a shift in tissue respiration from aerobic to anaerobic, resulting in increased pyruvate to lactate conversion in seminal plasma, which impacts sperm metabolism in the epididymis.[49,50] Ikpeme et al. tested 150, 300, 450, and 600 mg/kg/day of B. spectabilis leaves on male rat reproductive organs and fertility for 65 days. sperm count (9.38x106 per ml in control group to 6.76x106 per ml in treatment group), viability (86.55 percent in control group to 63.91 percent in treatment group), and motility (65.75 percent in control group to 42.75 percent in treatment group) decreased significantly. Sperm head abnormalities were also considerable, with the highest at 600 mg/kg (8.75%) compared to control (2.75 percent). The therapy group's testes weight decreased from 1.38 to 1.10 gram.[51,52,53]

Antioxidant Activity

Chaires-Martinez et al. tested B. spectabilis leaf and stem extracts for antioxidant activity. Stem aqueous extract from B. spectabilis reduced DPPH absorbance by 95.6%, with an IC50 of 0.03 g/mL.[54,55] Venkatachalam et al. tested methanolic and aqueous leaf extracts for phytochemicals and radical scavenging. Phytochemicals and antioxidant activity were higher in methanolic extract than aqueous.[56] Dhankhar et al. tested B. spectabilis leaf extracts in water, methanol, acetone, chloroform, and petroleum ether. The metal chelating assay, superoxide radical scavenging assay, and nitric oxide radical scavenging assay demonstrated that the plant's aqueous extract had antioxidant activity.[57]

Anti-inflammatory Activity

Mandal et al. examined the acute anti-inflammatory effect of B. spectabilis leaf extract using carrageenan and dextran, and the chronic anti-inflammatory activity using Freund's adjuvant-induced arthritis. 20 and 50 mg/kg B. spectabilis showed strong anti-inflammatory effects in carrageenan-induced acute inflammatory models. Dextran-induced edoema increased 30% and 66%. 50 mg/kg of this plant demonstrated considerable chronic anti-inflammatory efficacy compared to dexamethasone in an arthritic condition. [58].

Anti-ulcer Activity

Malairajan et al. examined B. spectabilis leaf extract's antiulcer activity. Antiulcer activity in three rat models Aspirin-induced stomach ulcer vs. ranitidine; ethanol-induced ulcer vs. sucralfate; water immersion stress-induced ulcer vs. omeprazole. Antisecretory, cytoprotective, and proton pump hypotheses were explored. The ethanolic extract of B. spectabilis reduced stomach volume, free acidity, total acidity, and ulcers 100%. The plant extract showed 89.71% cytoprotective efficacy and 72% protection index in water immersion stress-induced ulcer. This review suggests B. spectabilis as a traditional medicinal herb. [59]

Immunomodulatory Activity

Macrophage activation in female CD1 mice was studied by using an ethanol extract from B. x buttiana. In addition to lowering TNF- and increasing IL-10 and NO levels, the data demonstrated an increase in H2O2 and the creation and expansion of vacuoles, which is indicative of an immunomodulatory effect.[60,63]

Trombolytic Activity

Both the methanol extract of the leaves from B. glabra and the aqueous extract of the green leaves from B. spectabilis demonstrated thrombolytic action in vitro in the blood of healthy individuals.[61,62]

Cardiotonic Activity

An evaluation of the cardiotonic potential of an aqueous extract of B. glabra was carried out with the use of an isolated frog heart perfusion technique. Contraction force (HR), heart rate (HR), and cardiac output were the parameters that were investigated for this study (CO). The consumption of this extract led to an increase in HR and CO.[67]

CONCLUSION

A variety of Bougainvillea species, cultivars, and hybrids are discussed in this article, along with its medicinal, pharmacological, and toxicological applications. The pharmacological potential of Bougainvillea has not been fully explored, although it has been shown that this genus of plants has anti-inflammatory, antioxidant, immune-modulatory, antibacterial, and other beneficial effects in animal experiments.

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