WORLD JOURNAL OF PHARMACY AND PHARMACEUTICAL SCIENCES
ISSN 2278 – 4357 Impact Factor 8.025
Volume 14, Issue 11, 374-385 Review Article Coden USA: WJPPAJ

MORPHOLOGY, TRADITIONAL USES AND PHARMACOLOGICAL ACTIVITIES OF *BEGONIA MALABARICA*: AN OVERVIEW

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Article Received on 05 October 2025,
Article Revised on 25 Oct. 2025,
Article Published on 01 Nov. 2025,
https://doi.org/10.5281/zenodo.17480294

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How to cite this Article: Rayudu Mahesh Subramanyam, Abbireddy Subhash, Pallala Gowthami, Poleti Kiran Kumar, Panthagada Sunitha. (2025). Morphology, Traditional Uses And Pharmacological Activities Of *Begonia Malabarica*: An Overview. World Journal of Pharmacy and Pharmaceutical Sciences, 14(11), 374–385.
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ABSTRACT

Herbal medicine has been the cornerstone of traditional healthcare in India, with medicinal plants recognized for their therapeutic potential due to the presence of diverse secondary metabolites. *Begonia Malabarica* Lam., a member of the family Begoniaceae, is traditionally employed for its antihyperglycemic, antimicrobial, and wound-healing properties, as well as in the treatment of anemia, due to the presence of Alkaloids, Flavonoids, Phenolic compounds, Saponins, Quinines, Catechins, Carbohydrates, Proteins, Steroids, Resins, Tannins, and Thiols, and many other Secondary metabolites. This review consolidates and updates current knowledge on the phytochemical profile and pharmacological activities of *Begonia Malabarica.* By highlighting its bioactive constituents and therapeutic potential, the study provides a scientific basis for future pharmacological investigations and supports its traditional medicinal applications.

KEYWORDS: *Begonia Malabarica*, Herbal drugs, Phytochemicals, Pharmacological Activities.

1. INTRODUCTION

Begonias are one of the most diverse and rapidly evolving groups of flowering plants, with over 1900 species.[1,2] Humid tropical and subtropical regions are where they are primarily found. They are widespread throughout Asia, the Americas, and Africa, and they thrive in a variety of ecological niches, especially those with unique geological characteristics like limestone karst land. In certain regions of China, for example, begonias have a remarkably high natural diversity, and new species are regularly discovered. This demonstrates the genus's abundant biodiversity and the significance of these plants for maintaining ecological balance and possibly advancing pharmaceutical research. The topic is fascinating in both botany and medicine as a result of the continuous investigation and study of Begonia species, which continues to uncover their enormous biological and therapeutic value.[3]

Human exploitation is a significant additional stressor for these plants. Many begonia species are valued for their ornamental beauty and, in some cases, their medicinal uses.[4] Therefore, developing sustainable begonia conservation strategies is imperative. Three fundamental concepts need to be better understood in order to develop these strategies: the genetic diversity within and between species, the taxonomical clarity of begonia classification, and the overall conservation status of their ecosystems. Preserving the ecological balance of the specialized habitats that begonias are a part of is just as important as preserving individual plant species. With a strong foundation of research and carefully implemented conservation practices, it is possible to protect these valuable plants for future generations before it is too.[5]

2. *BEGONIA MALABARICA*



Fig. 1: *Begonia Malabarica.*

Begonia Malabarica belongs to the family Begoniaceae, species belong to the large pantropical genus Begonia. The genus Begonia is highly morphologically diverse and

consists mainly of tropical perennial flowering plants.[6] The leaves are used to treat stomach ulcers, stomach pain, and respiratory diseases.[7] For instance, Begonia erythrophylla has shown antimicrobial properties, whereas Begonia Heracleifolia, Begonia Damper Florens, and Begonia Fuchsioides species have been found to possess similar activities. Some Begonia species, such as Begonia Tuber hybrida var. alba, Begonia Plebeja, and Begonia Heracleifolia, have also been examined for their anti-tumor activities. These discoveries back the long-standing use of Begonia plants as medicines and confirm that they need more research in the healthcare industry.[8]

2.1. Taxonomy

The plant *Begonia Malabarica* belongs to the kingdom Plantae, which includes all plants. It is placed within the phylum Streptophyta, a major group that covers green algae and land plants. Within this phylum, it falls under the class Equisetopsida, though more commonly flowering plants like this are grouped with modern angiosperms. Its subclass is Magnoliidae, a large category that contains many broad-leaved flowering plants. The species is further classified under the order Cucurbitales, which is known for including a variety of flowering plants, often vines and herbs.[9, 10]

2.2. Geographical source

This plant species has been documented across various regions of India, particularly in the southern and central parts of the country. In Andhra Pradesh, it is found in East Godavari, Kadapa, Chittoor, and Srikakulam districts, while in Karnataka it occurs in the forested landscapes of Uttara Kannada and Shivamogga districts.[11] In Kerala, its presence is reported from the northern and central districts, including Kannur, Wayanad, Malappuram, Palakkad, and Thrissur. Moving towards Tamil Nadu, the species has been observed in the Namakkal, Tiruvannamalai, Vellore, and Tirunelveli districts. In addition, populations are also recorded in Madhya Pradesh, particularly within the Hoshangabad district. Since it occurs naturally in these habitats, it is regarded as native species rather than an exotic one, and its global distribution is restricted primarily to India and Sri Lanka.

2.3. Morphology

Malabar Begonia, or *Begonia Malabarica*, is a charming herbaceous plant common in southern Indian and Sri Lankan forests.[12,13] The perennial herb tends to grow stems up to a foot or two in length and repeatedly branched so the plant stays bushy and leafy during the

growing season. The stems are succulent and usually reddish in color and carry numerous persistent scars from the spots where leaves used to grow.

2.3.1 Leaves

The leaves are one of Malabar Begonia's most distinctive features. They usually range from two to four inches across, with a classic heart-shaped outline and a pointed tip. The base of each leaf is noticeably asymmetric one side is more deeply cordate than the other, which is rounded. The leaf edges bear fine teeth, giving a slightly serrated look, and the surface is often glossy and vibrant green, sometimes marked with reddish hues or faint white spots, especially in younger foliage. Leaf stalks are sturdy and vary in length from about one to five inches, providing space for the plant to display its foliage openly. Along the base of each leaf stalk, tiny stipules (approximately 5 mm across) persist, ovate and sharply pointed. The leaves are used for the treatment of respiratory infections, diarrhea, blood cancer, and skin diseases.[14]

2.3.2 Flowers

Flowers emerge singly from leaf axils, and they are usually borne upon short stems (peduncles) not more than a few inches long. The flower clusters are sparsely set; you won't discover clumpy clusters of blooms here but rather nice, modest arrangements. The blooms themselves are pale rose in color but frequently turn pure white or pale pink and in any event not crowded closely together, maintaining the plant's look as sheer and elegant. The male flowers have four sepals (petal-like portions), while female flowers have three sepals, a fact by which the plant differs from two-petal begonia forms, which have simply two sepals in the female and the male flowers. In full blossom in the late winter and springtime, these flowers add subtle coloration in the shade beneath the woodlands.[15]

2.3.3 Fruit

Once pollinated, the plant bears fruit in the form of capsules 1.8 by 1.8 cm in length, complete with broad wing-like projections.[16] The capsules are sharply formed and have a mass of very small oblong seeds ridged and often reticulate at one end.



Fig. 2: *Begonia Malabarica* fruits and flowers.

2.4. Active constituents of *Begonia Malabarica*

The qualitative Phytochemical screening of *Begonia Malabarica* leaves revealed the occurrence of varied significant compounds in different solvent extracts. Hexane, chloroform, and methanol extracts contained flavones, sterols, and terpenes. The chloroform and methanol extracts contained phenolic compounds. The quinones, saponins, tannins, and starch were also detected in the methanol extract. The remarkable point was the absence of alkaloids in any of the respective extracts.[17] The main important secondary metabolites are luteolin, quercetin and β-sitosterol. The secondary phytoconstituent from the leaves of B. malabarica revealed Friedelin, epi-friedelinol, -sitosterol, luteolin, quercetin and -sitosterol-3-d-glucopyranoside.

2.5. Traditional uses

Approximately 80% of Indian rural communities use plant remedies due to their accessibility, cheap price, and lesser occurrence of secondary effects. From the extensive array of medicinal plants reported around the world, Begonia genus species are remarkable for possessing traditional uses.[18] In this analysis, 41 Begonia species were discovered to possess medicinal value, notably *Begonia Malabarica* and a few more. Although Begonias are primarily celebrated for their adornment attribute, they have also been traditionally employed as a remedy in parts such as India, Chinese communities, and Southeast Asia. These plant species have been employed in the management of numerous disorders such as the following: the respiratory system (cough, asthma, bronchitis), gastrointestinal disorders (belly pains, diarrhea, ulcers), and dermatological disorders (wounds, acne, insect bites), and a few others such as fever, headache, hypertension, diabetes mellitus, and liver disorders. The best-represented plant parts are the leaves followed by stems, rhizomes, complete plants, and flowers and prepared typically in the forms of extracts, decoctions, or paste for either

application during baths or consumption by mouth. At times, stems and flowers are applied topically in the fresh form. This reflects the varied and significant value of Begonia species in traditional medicines.

2.6. PHARMACOLOGICAL ACTIVITIES OF *BEGONIA MALABARICA*

2.6.1. Ant oxidative activity

Free radicals, with their high reactivity, play crucial roles in various biological systems, influencing processes ranging from cellular signaling to disease pathogenesis.[19] Free radicals are unstable molecules that have lost electrons, making them highly reactive as they seek to restore balance by taking electrons from other molecules or cells. Within the body, these reactive species can initiate destructive oxidation reactions involving essential cellular components such as proteins, fats, DNA, carbohydrates, and RNA. This oxidative damage contributes to the onset of chronic degenerative diseases, including coronary heart disease, cancer, and the aging process. When the body's natural antioxidant defense system weakens, the extent of cell damage caused by free radicals increases. Although all biological systems possess innate antioxidant mechanisms that repair and remove damaged molecules, these systems may not always function efficiently. Consequently, consuming foods rich in antioxidants is vital for protecting cells against oxidative damage induced by free radicals.

The antioxidant activity was explored by utilizing the methanol extracts of the whole plant. The antioxidant activity was also examined for the total phenolic and flavonoid contents of the extracts due to the antioxidant activities of the contents. The antioxidant activity was tested by various in vitro models such as the DPPH radical scavenging activity test, reducing power test, and superoxide/anionic scavenging tests. Velusamy Kalpanadevi et al[20] results indicated that the phenolic and flavonoid rich methanol extracts of *Begonia Malabarica* possessed the inherent free-radical scavenging potential. The extract also exhibited high DPPH radical scavenging activity and the activity was improved as the concentration was increased. The extract also exhibited high reducing power and was capable of scavenging superoxide anions besides DPPH activity and hence confirming the potential of the plant as a powerful natural antioxidant.

Antioxidant activity by the DPPH radical scavenging method by Sakthivadivel et al,[21] revealed the dose-dependent activity in leaf, stem, and root extracts, the maximum inhibiting being the stem extract. The IC50 for the methanolic extracts was 0.77, 0.49, and 0.68 mg/mL

(leaf, stem, and root respectively) in the context of 0.44 mg/mL for ascorbic acid. This confirms high antioxidant potential primarily owing to phenolic and flavonoid contents.

2.6.2. Antidiabetic activity

Methanol extracts of *Begonia Malabarica* stem, given in doses of 100 and 200 mg/kg were investigated by Pandikumar P et al[22] for their antidiabetic activity in normal and diabetic rats by employing standard biochemical assays. Following streptozotocin induction of diabetes, rats treated with the extract experienced dramatic decreases in plasma glucose 34% in normal rats and more than 50% in diabetic rats along with impressive improvements in fasting and postprandial blood sugar, weight gain, and serum insulin and liver glycogen levels. Kidney function also became normal, as supported by decreasing urea and creatinine, but triglyceride and cholesterol did not change, verifying that the extract was highly effective for lowering blood sugar and nontoxic to liver and lipid metabolism.

In the present study, K. Kennedy Singh et al[23] explained that extracts of *Begonia Malabarica,* were obtained using varied solvents like petroleum ether, ethyl acetate, methanol, and water. These fractions were then filtered through in-vitro tests to assess their antidiabetic activity using inhibition of two of the major carbohydrate-digesting enzymes, α-glucosidase and α-amylase. Concurrently, antioxidant activity was measured by the DPPH radical scavenging assay, which mirrors the capacity of the extracts for neutralization of free radicals involved in oxidative stress and diabetes complications. The inhibitory activities of plant extracts were compared to acarbose, a control antidiabetic drug, while antioxidant activity was compared to control antioxidants ascorbic acid and gallic acid, while *Begonia Malabarica* showed no significant α-glucosidase or α-amylase inhibition in the assays; it had one of the highest antioxidant activities of all the plants tested.

2.6.3. Anti-epileptic activity

The measure of antiepileptic activity by Dhote, S et al[24] in plant extracts normally entails the application of standard experimental protocols in animal models to assess the potency of the extract to inhibit or suppress seizures. Most of the time, rodents like rats or mice are employed for assessment. The experimental process may begin with separating the animals into groups, comprising controls, different doses of the plant extract, and a comparison standard drug group. The extract is given perorally or intra peritoneally, and the seizures are induced using chemical convulsants such as pentylenetetrazole (PTZ), or by applying electrical stimulation in techniques such as maximal electroshock (MES). In PTZ, the latency

to onset of the seizure, time, and severity of the convulsions are measured following the administration of the convulsant, whereas in the MES, inhibition of tonic hind limb extension by the extract is observed. Observations are of a fixed duration, say 30 minutes to a few hours and seizure parameters like frequency, intensity, and duration are measured carefully. Anticonvulsant activity is implied by comparing the seizure parameters in treated groups to that of the control group. The collected data are then analyzed statistically to calculate the significance of the protective effects of the extract. These procedures enable researchers to determine the ability of plant-derived compounds to act as antiepileptic drugs by regulating neural excitability and seizure thresholds. The process enables a proper assessment of the pharmacological action of the plant extract while ensuring consistent experimental conditions.

2.6.4. Antibacterial activity

Antimicrobial activity of *Begonia Malabarica* has been shown by Ariharan V, Shobi T, et al[25-27] that the inhibition of the growth of many pathogenic bacteria. One of its important bioactive constituents, dibutyl phthalate, inhibits a broad range of microorganisms. When tested at elevated concentrations of 100 mg/ml, it effectively inhibited bacterial growth such as that of *Staphylococcus epidermidis*, *Streptococcus pneumoniae*, *Escherichia coli*, *Micrococcus luteus*, *Klebsiella pneumoniae*, *Shigella flexneri*, *Vibrio cholerae*, *and Pseudomonas aeruginosa.* The inhibition was confirmed by a visible clear zone surrounding the treated samples, indicative of the compound's high antibacterial activity. Surprisingly, both E. coli and *Pseudomonas Aeruginosa* were always found to have pronounced inhibition zones in all concentrations that had been tested, implying that the organisms are highly sensitive to the compound, at reduced concentrations, the extract still showed excellent effects, even though the level of inhibition varied according to the bacterial strain. For instance, *Streptococcus pneumoniae* showed a uniform inhibitory effect with quantifiable zones when the concentration was lowered to 50, 25, and 12.5 mg/ml. Likewise, other microorganisms like *Staphylococcus epidermidis*, *Klebsiella pneumoniae*, and *Shigella flexneri* had moderate but definite inhibition when treated at the concentrations of 25, 12.5, and 6.25 mg/ml, respectively.

2.6.5. Cytotoxicity activity

Cytotoxicity activity tests are used to screen chemicals, pharmaceuticals, or natural compounds like plant extracts to determine their potential to kill or damage cells. This

activity can be beneficial, such as targeting cancer cells, or harmful, such as unwanted toxicity to normal cells. Cytotoxicity activity is measured using various in vitro assays that detect changes in cell viability, membrane integrity, enzyme activity, or metabolic function.[28,29] Sakthivadivel, S., Arumugam, et al[30] performed Assay on PANC-1 cells were used to test the cytotoxicity of methanolic extracts of B. Malabarica. The MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) assay, a homogenous colorimetric assay, was employed to evaluate cell viability in a 96-well plate format optimized for high-throughput screening (HTS). The human pancreatic cancer cell line PANC-1 was seeded at a density of 1×10^4 cells per well in EMEM medium supplemented with 10% fetal bovine serum and 1× antibiotic-antimycotic solution. Following overnight incubation to allow cell attachment, the cells were washed with 200 µL of 1× phosphate-buffered saline (PBS) and subsequently treated with varying concentrations of the test compound in serum-free medium for 24 hours. After treatment, the medium was aspirated, and an MTT solution (0.5 mg/mL in 1× PBS) was added to each well and incubated for 4 hours at 37°C in a CO_2 incubator. Post incubation, the MTT solution was carefully removed, and the wells were rinsed with 200 µL of PBS. The resulting formazan crystals were solubilized by adding 100 µL of dimethyl sulfoxide (DMSO) to each well and thoroughly mixed to ensure complete dissolution. The absorbance was measured at 570 nm using a microplate reader. The formation of the purple-blue formazan dye indicated the metabolic activity of viable cells, correlating with cell viability.

CONCLUSION

This literature review highlights that Begonia species are extensively utilized in traditional medicine for the treatment of various human ailments, particularly respiratory, digestive, and dermatological disorders. *Begonia Malabarica* is an ornamental and medicinally valuable plant found in the Western Ghats and other tropical regions. Known for its attractive foliage and flowers, it plays an important role in biodiversity and traditional medicine, where it is used for its Antimicrobial, Anti-inflammatory, Anti-epileptic**,** Antidiabetic, Antioxidative activity**,** and wound-healing properties. Conservation of this species is essential due to its ecological significance and therapeutic potential, making it an important plant for both environmental and pharmaceutical research.

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