



**INTERNATIONAL JOURNAL OF
PHARMACEUTICAL SCIENCES**
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: <https://www.ijpsjournal.com>



Review Article

A Review on Himalayan Balsam (*Impatiens Glandulifera*)

Dev Prakash Dahiya¹, Bhavneswari Devi^{*2}, Shivani³, Anchal Sankhyan⁴, Nishant Verma⁵

^{1,2,3,4}School of Pharmacy, Abhilashi University, Chail-Chowk, Himachal Pradesh, India 175028

⁵School of Pharmacy, Vidya University, Meerut, Uttar Pradesh, India 250002.

ARTICLE INFO

Published: 02 April. 2025

Keywords:

Flavonoids, Anti-inflammatory, Antidepressant, *Impatiens*.

DOI:

10.5281/zenodo.15126683

ABSTRACT

Impatiens glandulifera belongs to family Balsaminaceae. It is found in the foothills of the western Himalaya, i.e. India, Pakistan, Nepal and also in European countries. Different parts of the plant has been used to treat various ailments. It is effective in joint pain. Plant seeds are chewed or seed oil is used as tonic and for the treatment of anxiety. The root extract or paste made from roots are applied to cool hands and feet. Roots, leaves and flowers powders and decoctions are used for depression and hypnosis. It is very good antidote for snake bites. Paste of leaves is applied externally to treat burns. The infusion from flowers is used for eye washes. Flowers are used as cathartic, diuretic, and emetic. *Impatiens glandulifera* has been reported to have anti-oxidant, anti-microbial, anti-proliferative, anti-cancer activity and also effective for some nervous system disorders. The main phytoconstituents found in plant are flavonoids, quinones, terpenes, sterols, coumarins, fatty acids, volatile compounds, essential oils.

INTRODUCTION

Plants have served as foundational pillars within global traditional medical systems, driving pharmaceutical innovation that continues to shape modern therapeutics. Natural compounds and their derivatives currently constitute over 50% of therapeutic medications, underscoring their enduring relevance.[1] India's pioneering role in advancing indigenous medicinal systems merits emphasis, with mineral and plant-derived

formulations remaining integral to disease management. Notably, the global resurgence of alternative medicine reflects evolving stakeholder alignment with holistic care paradigms.[2] *Impatiens glandulifera* is a herb that belongs to family Balsaminaceae. It is having erect stem (5–50 mm diameter, 1–2.5 m height) features hollow core with peripheral lignified vascular tissue, while root system combine cylindrical primary roots (2–4 mm) with 146 ± 35

***Corresponding Author:** Bhavneswari Devi

Address: Late Narayandas Bhawandas Chhabada Institute of Pharmacy Raigaon Satara.

Email ✉: keshavasp3@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



adventitious roots (15–20 cm length). Flowers demonstrate chromatic variability (purple/pink/white), complemented by distinctive five-angled fruit capsules (1.5–5 cm × 0.4–1.5 cm) (Fig. 1b). Arranged in whorls of 2–5, the lanceolate-ovate leaves (5–18 cm × 2.5–7 cm) exhibit 18–50 serrations per margin and acuminate

apices (Fig. 1c). The extrafloral purple basal nectaries are potential reservoirs of naphthoquinones that warrant further phytochemical analysis. Seed morphology reveals pale grey-brown to black oval-globose structures (3–7 mm × 2–5 mm × 1–2 mm) with rugose coats (Fig. 1d).[3,4]



Fig. 1. *Impatiens glandulifera*'s morphology.

A Whole plant, b. Detail of flower and capsules, c. Leaves, d. Seeds

Plant Taxonomy

Kingdom : Plantae
Phylum : Magnoliophyta
Class : Magnoliopsida
Order : Geraniales
Family : Balsaminaceae
Genus : *Impatiens*
Species : *Impatiens glandulifera*

Geographical Distribution

Impatiens glandulifera distribution spans Pakistan's northeast, India's Jammu and Kashmir, Himachal Pradesh, Uttarakhand regions, Nepal's western territories and selective European zones at an elevation of 2000-4000 m. The morphology enable proliferation across urban landfills, forest clearings,[3,4]

Preliminary Phytocheical Screening

Preliminary phytochemical screening was performed on ethanolic extract of *Impatiens*

glandulifera. The secondary metabolites that are present in the plant are enlisted in Table 1.

Table 1: Various secondary metabolites identified in *Impatiens glandulifera*[5]

Sr. No.	Constituents	Test	Result
1	Phenolic acids & Tannins	Ferric Chloride Test	+ve
2	Flavonoids	Lead Acetate Test	+ve
3	Quinones	Borntrager Test	+ve
4	Coumarin	Sodium Hydroxide Test	+ve
5	Steroids & Terpenoids	Libermann-Burchard test	+ve
6	Glycosides	Sulphuric Acid Test	+ve
7	Proteins	Millon's Test	+ve
8	Carbohydrates	Fehling Test	+ve
9	Amino acids	Ninhydrin test	-ve
		Test for tyrosine	-ve
		Test for cysteine	-ve
10	Alkaloids	Mayer's Test	-ve

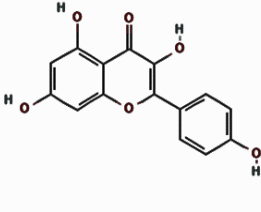
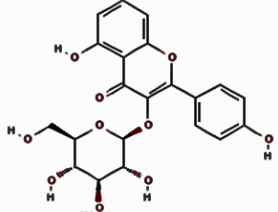
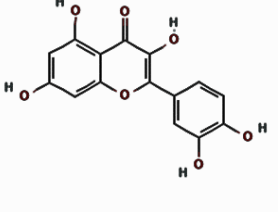
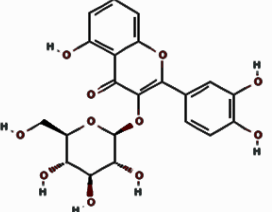
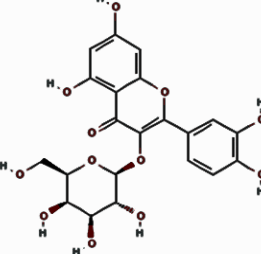
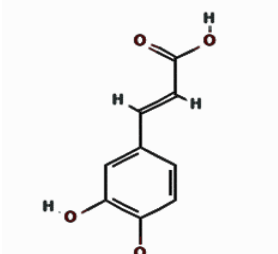
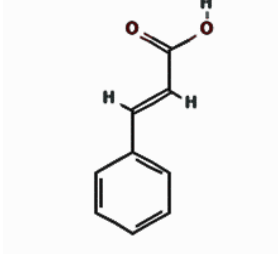
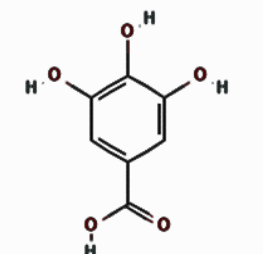
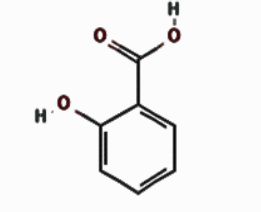
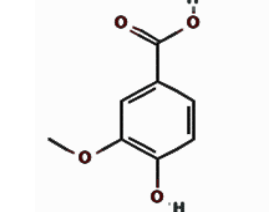
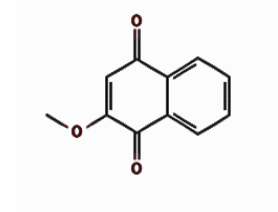
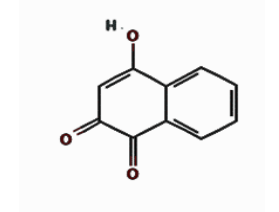
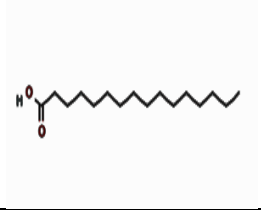
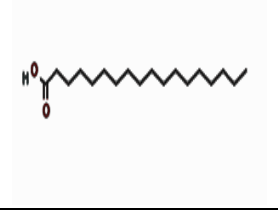
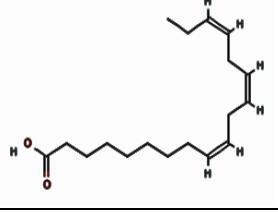
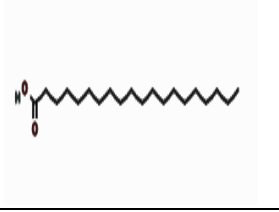
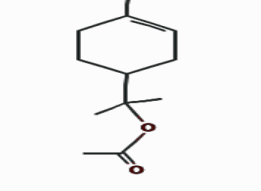
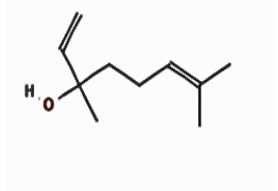
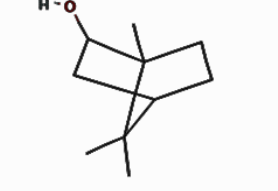
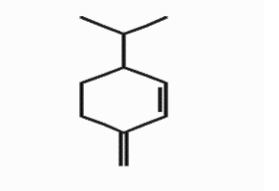
Phytochemistry

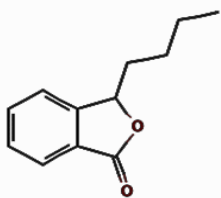
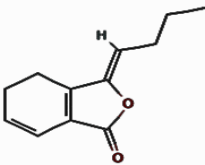
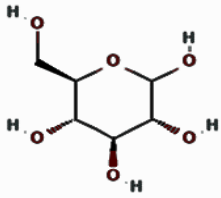
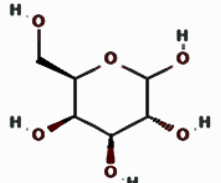
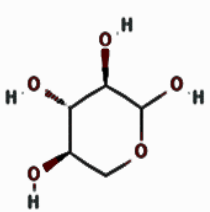
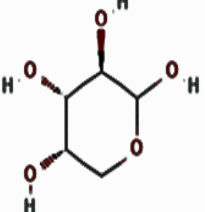
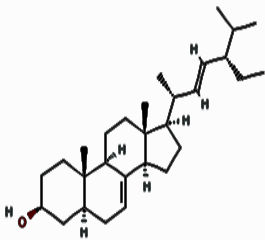
The phytochemical composition of *Impatiens glandulifera* includes a variety of bioactive compounds found in different parts of the plant, including leaves, flowers, aerial parts, roots, stems, seed oil, their structures are compiled in Table 2. Flavonoids such as kaempferol, astragalin, quercetin, isoquercitrin, hyperoside (Fig. 2-6) and their glycosides are predominantly present in leaves, flowers and aerial parts contributing to antioxidant, anti-inflammatory and potential anticancer properties. Phenolic acids like caffeic acid, cinnamic acid, gallic acid, salicylic acid, and vanillic acid (Fig. 7-11) are widely distributed in flowers, roots and leaves playing crucial roles in plant defense and offering antimicrobial, anti-inflammatory and antioxidant benefits. Naphthoquinones such as 2-methoxy-1,4-naphthoquinone and 2-hydroxy-1,4-naphthoquinone (Fig. 12 & 13) are found in flowers, leaves and stems, known for their antimicrobial activities. Various fatty acids, including palmitic acid, stearic acid, linolenic acid

and arachidic acid (Fig. 14-17) are abundant in seed oil and flower stalks, playing essential roles in plant metabolism and exhibiting potential health benefits such as anti-inflammatory and cardioprotective agent. The herb and roots contain significant volatile compounds such as α -terpinyl acetate, linalool, borneol, β -phellandrene, butylphthalide and ligustilide (Fig. 18-23) which are known for their aromatic properties and potential therapeutic effects, including sedative, antispasmodic actions. Additionally, carbohydrates like glucose, galactose, xylose and arabinose (Fig. 24-27) are found in the aerial parts and roots, essential for energy storage and structural functions. Other unique bioactive compounds such as α -spinasterol (Fig. 28), glanduliferins A and B and parinaric acid (Fig. 29) contribute to various pharmacological activities, including anti-inflammatory and antioxidant. The presence of diverse secondary metabolites suggests the plant's significant medicinal potential, supporting its traditional and modern therapeutic applications. [6, 7, 8, 9]



Table 2: Structure of Phytochemicals

			
Fig. 2 Kaempferol	Fig. 3 Astragalol	Fig. 4 Quercetin	Fig. 5 Isoquercitrin
			
Fig. 6 Hyperoside	Fig. 7 Caffeic acid	Fig. 8 Cinnamic acid	Fig. 9 Gallic acid
			
Fig. 10 Salicylic acid	Fig. 11 Vanillic acid	Fig. 12 2-Methoxy-1,4-naphthoquinone	Fig. 13 2-Hydroxy-1,4-naphthoquinone
			
Fig. 14 Palmitic acid	Fig. 15 Stearic acid	Fig. 16 Linolenic acid	Fig. 17 Arachidic acid
			
Fig. 18 α -Terpinyl acetate	Fig. 19 Linalool	Fig. 20 Borneol	Fig. 21 β -Phellandrene

			
Fig. 22 Butylphthalide	Fig. 23 (Z)-Ligustilide	Fig. 24 Glucose	Fig. 25 Galactose
			
Fig. 26 Xylose	Fig. 27 Arabinose	Fig. 28 α -Spinasterol	Fig. 29 Parinaric acid

Ethnopharmacological Activities

I. glandulifera demonstrates therapeutic efficacy in joint pain management. As both a general tonic and targeted treatment, seeds are chewed to address anxiety and joint discomfort. Through standardized preparation methods, powdered roots/leaves/flower decoctions function as psychotropic adjuvants and venom countermeasures. External application of leaves show good results in burn remediation. Ophthalmic solutions derived from floral infusions demonstrate sanitizing properties. The species' blossoms are further employed in arthralgia mitigation alongside purgative, emetic and diuretic interventions. Flowers are also incorporated into snakebite antidotes. Leaf-based preparations provide localized cooling through epidermal application. Nutritional utilization patterns confirm the plant's fruits, seeds, foliage and stems as viable dietary components.[10]

Biological Activity

Antioxidant activity

Three extraction modalities—Soxhlet, ultrasound-assisted, and accelerated solvent were systematically compared for phenolic acid recovery from *I. glandulifera* floral and vegetative tissues. Operational parameters (80-120°C, 100 bar) produced TPAC values of 188.07-281.82 $\mu\text{g/mL}$, with Soxhlet-derived flower extracts exhibiting peak DPPH neutralization (IC_{50} 0.06 mg/mL). HPLC-ESI-MS/MS profiling identified protocatechuic acid as the dominant constituent, accompanied by gentilic acid, trans-caffeic acid, vanillic acid, p-hydroxybenzoic acid, syringic acid, p-coumaric acid, salicylic acid, cis-ferulic acid, cis-caffeic acid, gallic acid and 3-hydroxy cinnamic acid as ancillary phenolic acids showing tissue-specific distribution patterns.[7] Methanol extraction of aerial parts yielded 2-methoxy-1,4-naphthoquinone, aempferol 3-O-glucoside (astragalin), quercetin 3-O-glucoside (isoquercetin), kaempferol 3-O-rutinoside (nicotiflorin), kaempferol 3-O-rhamnosyldiglucoside, p-hydroxybenzoic acid, protocatechuic acid, kaempferol 3-O-galactoside (trifolin), hyperoside, eriodictyol, and eriodictyol 7-O- β -D-glucoside phenolic compounds, their antioxidant potential quantified through dual

radical assays. Isoquercetin emerged as the most potent agent, demonstrating IC₅₀ values of 0.11 mg/mL (DPPH) and 0.01 mg/mL (ATBS). This compound cluster including hyperoside and eriodictyol derivatives highlights the species' diverse phytochemical repertoire.[8] Essential oil hydrodistillation from aerial structures produced superior antioxidant outcomes versus root-derived equivalents, evidenced by DPPH IC₅₀ 3.96 µg/mL and linoleic acid inhibition at 102.08 µg/mL. GC-MS analysis of the 0.22% w/yield oil identified β-phellandrene (7.4%) and α-terpinyl acetate (16.6%) as major constituents, with aromatic volatiles comprising 23% of the total phytocomplex.[9] Analysis revealed pronounced antioxidant activity in esterified fractions from *I. glandulifera* seed, leaf and root extracts. Notably, DPPH radical scavenging efficacy was most pronounced in the leaf-derived fatty acid fraction (IC₅₀ 11.69 µg/mL), with metal chelation capacity peaking at IC₅₀ 5.49 µg/mL. GC-MS/FID quantification identified α-linolenic acid dominance (40.5%) within this bioactive profile.[11] Polysaccharide extraction methodologies were optimized through hydroalcoholic maceration and ultrasound-assisted techniques. GC-FID characterization demonstrated galacturonic acid as the primary monosaccharide across *Impatiens* species, with *I. glandulifera* yielding maximal concentrations. Subsequent in-vitro evaluation confirmed superior antioxidant performance in these polysaccharide matrices.[12]

Anti-inflammatory and analgesic activities

Researchers isolated polysaccharides from aerial parts and roots of *I. glandulifera*, demonstrating a 32.7% reduction in IL-8 expression within LPS-stimulated human neutrophils at 50 µg/mL concentrations during in vitro testing. Cytotoxicity assessments revealed no adverse effects on cell

viability at this dosage, confirming biocompatibility.[12] The findings suggest optimized therapeutic potential through targeted inflammatory pathway modulation.

Antimicrobial activity

Analysis reveals the aerial parts extract of *Impatiens glandulifera* exhibited no measurable impact on Gram-negative bacterial growth. Antibacterial efficacy against Gram-positive pathogens was demonstrated through agar dilution testing, targeting *S. aureus*, *S. epidermidis*, *M. luteus*, *B. subtilis*, *B. cereus*, *Str. pneumoniae*, and *Str. pyogenes*. Broad-spectrum antimicrobial activity characterizes *I. glandulifera*, with operational thresholds revealing strategic potential. Minimum inhibitory concentrations ranged from 250 to 1000 µg/ml across reference strains, findings suggesting mild to moderate bioactivity gradients.[13]

Antineoplastic activity

Pharmacological profiling of *I. glandulifera* seed derivatives revealed triterpenoid fractions from petroleum ether extracts (45-60°C) exhibited heightened efficacy against HL-60 and HL-60/MX2 leukemia models, displaying IC₅₀ ranges from 11.69-88.07 µg/mL. Chromatic analysis confirmed α-spinasterol acetate as the dominant compound within these bioactive fractions, constituting 21.63% of the isolated material.[11] Cytotoxicity evaluations demonstrated enhanced activity in ethyl acetate stem extracts from *I. glandulifera* across A-549, U373, and SMEL-28 cell lines, with stem-derived material showing superior potency (median IC₅₀ 33 µg/mL). Two key phytoconstituents—2-methoxy-1,4-naphthoquinone and spinasterol were isolated through targeted fractionation of stems, leaves, and roots. Also, glanduliferin A and B were uniquely identified in stem extracts. Against



SMEL-28 melanoma lines, 2-methoxy-1,4-naphthoquinone emerged as the primary cytotoxic agent, achieving IC₅₀ values between 2-3 µg/mL.[14]

This presents an opportunity to explore structure-activity relationships within the triterpenoid class for therapeutic development.

Antidepressant and anxiolytic activities

Protocatechuic acid and hyperoside, isolated from *I. glandulifera*'s ethanolic extract demonstrated antidepressant efficacy in Albino Swiss mice. Immobility time decreased significantly at 1.875 mg/kg intraperitoneal doses during Forced Swim Test and Tail Suspension Test evaluations. The hippocampal Brain Derived Neurotrophic Factor levels increased substantially at elevated doses of 3.75 mg/kg and 7.5 mg/kg. This mechanism appears central to the observed neuroregulatory effects, with BDNF upregulation serving as a probable mechanistic pathway for mood disorder remediation.[15]

CONCLUSION

The plant *Impatiens glandulifera* consist a variety of phytoconstituents. Since much research work has not been done on plant and very less literature is available. The studies exhibit the different type of compounds like flavonoids, glycosides, phenolics, phytosterols, triterpenoids, peptides and activities that has been reported, antioxidant, cytotoxic, antimicrobial, analgesic, anti-inflammatory, antidepressant and anxiolytic effects are the most frequent. Ethnobotanical information can guide to explore this plant for phytoconstituents and pharmacological screening and to make use of this plant in vivo pharmacological study may be conducted. It is concluded that the plant is of many uses.

Abbreviations

MIC	Minimum Inhibitory Concentration
IC	Inhibitory Concentration
LPS	Lipopolysaccharides
GC-FID	Gas Chromatography with Flame Ionization Detector
GC-MS	Gas Chromatography Mass Spectrometry
ATBS	2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid)
DPPH	2,2-diphenyl-1-picrylhydrazyl

REFERENCES

1. Dhiman S, Dahiya DP, Sharma S, Phytochemical analysis, Antioxidant and Antimicrobial Screening of Shoot Extracts of *Viola odorata* linn. from Shikari Devi Wildlife Sanctuary, Himachal Pradesh, India, International Journal of Ayurvedic Medicine, 2024;15(1): 212-8.
2. Devprakash TR, Gurav S, Kumar GP, Mani TT, An review of phytochemical constituents and pharmacological activity of *Plumeria* species, International Journal of Current Pharmaceutical Research, 2012;4(1):1-6.
3. Pires Jr EO, Caleja C, Garcia CC, Ferreira IC, Barros L, Current status of genus *Impatiens*: Bioactive compounds and natural pigments with health benefits, Trends in Food Science & Technology 2021;117:106-24.
4. Helsen K, Diekmann M, Decocq G et al., Evolution and Systematics, Biological flora of Central Europe: *Impatiens glandulifera* Royle, Perspectives in Plant Ecology, 2021;50:125609.
5. Sharma V, Kumar N, Prakash D, Chanchal D K, Pathak V, Phytochemical screening, Chromatographic and In-vitro Antioxidant Studies on The Extracts of Selected Plant, Turkish Journal of Physiotherapy and Rehabilitation, 2023;32(3):15656-15662.



6. Szewczyk K, Phytochemistry of the genus *impatiens* (Balsaminaceae): A review, Biochemical Systematics and Ecology, 2018;80:94-121.
7. Szewczyk K, Olech M, Optimization of extraction method for LC–MS based determination of phenolic acid profiles in different *Impatiens* species, Phytochemistry Letters, 2017;20:322-330.
8. Szewczyk K, Sezai Cicek S, Zidorn C, Granica S, Phenolic constituents of the aerial parts of *Impatiens glandulifera* Royle (Balsaminaceae) and their antioxidant activities, Natural Product Research, 2019;33(19):2851-2855.
9. Szewczyk K, Kalembe D, Komsta Ł, Nowak R, Comparison of the Essential Oil Composition of Selected *Impatiens* Species and Its Antioxidant Activities, Molecules, 2016;21(9):1162.
10. Delgado-Rodríguez FV, Weng-Huang NT, Loría Gutiérrez A, Arias-Nunez D, Rosales-Leiva C, Ethnobotany, Pharmacology and Major Bioactive Metabolites from *Impatiens* Genus Plants and Their Related Applications, Pharmacy Reviews, 2023;17(34):338-381.
11. Szewczyka K, Bonikowskib R, Maciąg-Krajewskab A, Abramekc J, Bogucka-Kocka A, Lipophilic components and evaluation of the cytotoxic and antioxidant activities of *Impatiens glandulifera* Royle and *Impatiens noli-tangere* L. (Balsaminaceae), Grasas Aceites, 2018;69(3):e270.
12. Szewczyk K, Heise EM & Piwowarski JP, Preliminary characterization and bioactivities of some *Impatiens* L. water-soluble polysaccharides, Molecules, 2018;23(3):631.
13. Szewczyk K, Zidorn C, Biernasiuk A, Komsta L, Granica S, Polyphenols from *Impatiens* (Balsaminaceae) and their antioxidant and antimicrobial activities, Industrial Crops and Products, 2016;86:262-72.
14. Cimmino A, Mathieu V, Evidente M, Ferderin M, Moreno Y, Banuls L et al., Glanduliferins A and B, two new glucosylated steroids from *Impatiens glandulifera*, with in vitro growth inhibitory activity in human cancer cells, Fitoterapia 2016;109:138-45.
15. Orzelska-Gorka J, Szewczyk K, Gawronska-Grzywacz M, Kedzierska E, Głowacka E, Herbet M et al., Monoaminergic system is implicated in the antidepressant-like effect of hyperoside and protocatechuic acid isolated from *Impatiens glandulifera* Royle in mice, Neurochemistry International, 2019;128:206-14.

HOW TO CITE: Dev Prakash Dahiya, Bhavneswari Devi*, Shivani, Anchal Sankhyan, Nishant Verma, A Review on Himalayan Balsam (*Impatiens Glandulifera*), Int. J. of Pharm. Sci., 2025, Vol 3, Issue 4, 273-280 <https://doi.org/10.5281/zenodo.15126683>