International Journal of Advanced Technology in Engineering and Science
Vol. No. 12, Issue No. 07, July 2024
www.ijates.com
ijates
ISSN 2348 - 7550

Unleashing the therapeutic secrets of Barleria prionitis

Riya Ahlawat[1], Kamakshi Saxena[2], Kumud Gaur[3], Anjali Singh[4]

[1,3]Department of Biotechnology, SRM IST Delhi NCR campus, Modinagar, Ghaziabad 201204

[2,4]Department of Biology, Science and Humanities, SRM IST Delhi NCR campus, Modinagar, Ghaziabad

*ra3444@srmist.edu.in, *kamakshr@srmist.edu.in*

Abstract -

Barleria prionitis, botanically referred to as "Porcupine Flower" is a well-acknowledged medicinal plant with a multitude of therapeutic applications in conventional medical systems. Barleria prionitis' pharmaceutical potential and therapeutic properties are the subjects of a review that summarizes and compiles pertinent scientific research. As a result of its diverse range of biological activity, the plant has a rich phytochemical profile that includes phenolic chemicals, flavonoids, terpenoids, and alkaloids. Research shows that it effectively displays qualities that include wound healing, hepatoprotective, anticancer, antioxidant, antibacterial, and anti-inflammatory. Furthermore, this species of Barleria has been also shown to have the potential to treat several illnesses including gastrointestinal problems, metabolic disorders, and skin disorders. Barleria prionitis has the potential to be a fully developed therapeutic agent but more research and thorough scientific studies are needed to fully understand the principles underlying these therapeutic actions.

Keywords – Barleria prionitis, Acanthaceae, medicinal uses, therapeutic agent, Anti-bacterial.

Introduction -

Barleria prionitis, also referred to as Vajardanti and Kala bansa in Ayurveda, is a perennial herbaceous plant that is native to tropical regions of Asia and Africa[1]. It is a member of the Acanthaceae family and is distinguished by its vivid orange-to-red flowers and thorny branches[2]. However, the extensive medicinal potential within its various parts sets this plant apart from others. *Barleria prionitis* has long been an essential component of traditional medicine in these areas. Its leaves, roots, and flowers have all been used in traditional medicine due to their various health benefits; its widespread application in Ayurvedic, Siddha, and Unani medicine systems emphasizes its importance in treating a wide range of ailments. The real power of *Barleria prionitis* is found in its wide range of bioactive substances, which include phenolic compounds, alkaloids, flavonoids, and terpenoids. Its many therapeutic qualities, including anti-inflammatory, antibacterial, wound-healing, hepatoprotective, and possibly anticancer actions[3], are based on these ingredients.

Barleria prionitis is ideally situated at the nexus of traditional knowledge and contemporary research as the globe continues to explore the benefits of botanical therapy. Its historical relevance and potential for modern medicine are not the only things that make it alluring. Though conventional methods attest to their effectiveness, thorough research and rigorous scientific investigation are necessary to fully realize their therapeutic potential and incorporate it into conventional medicine. The tale of *Barleria prionitis* reveals a tapestry of possibilities where

the gifts of nature blend with the quest for scientific knowledge, promising new treatments and medical breakthroughs that are just waiting to be discovered.

1) Classification *Barleria prionitis* L.

Kingdom – Plantae
Division - Magnoliophyta
Class - Magnoliopsida
Order - Scrophulariales
Family - Acanthaceae
Genus - *Barleria*
Species - *prionitis*

Figure 1: *Barleria prionitis* plant

2) Plant Taxonomy –

The leaves have an oblong to elliptic shape. There are spines at the axils that are 5–20 mm long[4]. Yellow, sessile blooms can be seen in terminal branching spikes or leaves' axils as shown above in Fig.1. The capsule has two oval, 10–20 mm long cells, and a roughly 6 mm long, shape-pointed beak [1].

3) Geographical Distribution –

Barleria prionitis thrives in various climatic conditions of tropical and subtropical regions of-

- Asia
- Africa
- Australia

Various Species of Barleria found in India -

List Of Barleria species found in India		
NAME	**HABITAT**	**DISTRIBUTION**
B.prionitis	Ravines and shady habitats in deciduous forests and also grown in gardens	Throughout India
B.acanthoides	Rocky localities, dry hillslopes	Gujarat, Haryana, Punjab and Rajasthan
B.buxifolia	Open lands especially in drier parts	Andhra Pradesh, Karnataka, Kerala, Punjab, Tamil Nadu

B.cristata	Cultivated and also found as an escape	Throughout India
B.longiflora	Rocky crevices in drier regions and along dry hill slopes	Andhra Pradesh, Karnataka, Maharashtra, Odisha, Tamil Nadu
B.mysorensis	Deciduous forests and in exposed rocky localities	Andhra Pradesh, Karnataka, Kerala, Tamil Nadu
B.noctiflora	Scrub forests at lower altitudes	Andhra Pradesh, Karnataka, Tamil Nadu
B.pilosa	Shady habitat	Tamil Nadu - Western Ghats (endemic)
B.repens	Tropical and subtropical climate	Karnataka, Maharashtra
B.tomentosa	Rocky crevices in drier regions	Andhra Pradesh, Karnataka, Kerala , Tamil Nadu
B.acuminata	Open hilly regions as well as roadside	Andhra Pradesh, Karnataka, Kerala, Tamil Nadu
B.courtallica	Deep shade localities, moist evergreen at higher altitudes	A.P., Karnataka, Kerala, Madhya Pradesh, T.N., Maharashtra
B.involucrata	Along roadsides at higher altitudes	Western Ghats of Karnataka and Kerala
B.lawii	Open hillslopes in sholas and dry and moist deciduous forests	Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra
B.nitida	On rocky hillslopes in dry and moist deciduous forests	Karnataka , Tamil Nadu
B.strigosa	Undergrowth in moist deciduous forests, also grown in gardens up to 1400m	Throughout India
B.terminalis	Along streams in higher altitudes	Goa, Karnataka, Maharashtra, Odisha
B.vestita	Dry tropical biome	Tamil Nadu (Nilgiri)
B.cuspidata	Dry plains and rocky hillslopes	A.P., Karnataka, Kerala, Maharashtra, Rajasthan, Tamil Nadu
B.lupulina	Cultivated in gardens also found as an escape	Bihar, H.P., M.P., Maharashtra, Odisha, T. N., U. P., W. Bengal
B.hochstetteria	Rocky localities in desert	Gujarat, Rajasthan
B.gibsonii	Grassyhilltops and slopes at higher altitudes	A.P., Gujarat, Karnataka, M.P., Odisha, Maharashtra, T.N.

B.grandiflora	Exposed forest margins along roadside, hillslopes in home gardens	Goa, Karnataka, Maharashtra
B.montana	On exposed hill slopes above 1000m	A.P., Bihar, Karnataka, Kerala, M.P., Odisha, T.N., Maharashtra
B.prattensis	Undergrowth in deciduous forests	A.P., Dadra and Nagar Havelli, Goa, Gujarat, Karnataka, Kerala M.P., Maharashtra,Rajasthan , Tamil Nadu

Table 1: List of various species of Barleria found in India[5]

Phytochemicals found in *Barleria prionitis* –

Barleria prionitis, also referred to as Vajradanti or Porcupine flower, is a plant that has several phytochemicals that give it its therapeutic qualities. Several noteworthy phytochemicals have been detected in *Barleria prionitis*, including:

Alkaloids: These are nitrogen-containing substances that frequently display a range of pharmacological properties. Alkaloids with potential bronchodilators and anti-inflammatory effects, such as vasicine and vasicinone, are present in *Barleria prionitis*[6].

Flavonoids: These substances are well-known for their anti-inflammatory and antioxidant properties. Flavonoids like quercetin, luteolin, and apigenin are present in *Barleria prionitis* and contribute to its potential for healing[7].

Triterpenoids: *Barleria prionitis* contains triterpenoids which include β-sitosterol and lupeol. Numerous studies have shown their analgesic and anti-inflammatory qualities [3].

Phenolic Compounds: *Barleria prionitis* contains phenolic compounds such as ellagic acid and gallic acid. These substances are well-known for having anti-cancer and antioxidant qualities [6].

Saponins: These substances possess a variety of pharmacological actions, such as antibacterial and anti-inflammatory characteristics. Saponins found in *Barleria prionitis* add to its medicinal value [5].

Steroids: It has been discovered that *Barleria prionitis* contains some steroid molecules, such as β-sitosterol and stigma-sterol. These substances have demonstrated potential immune-modulatory and anti-inflammatory properties[8].

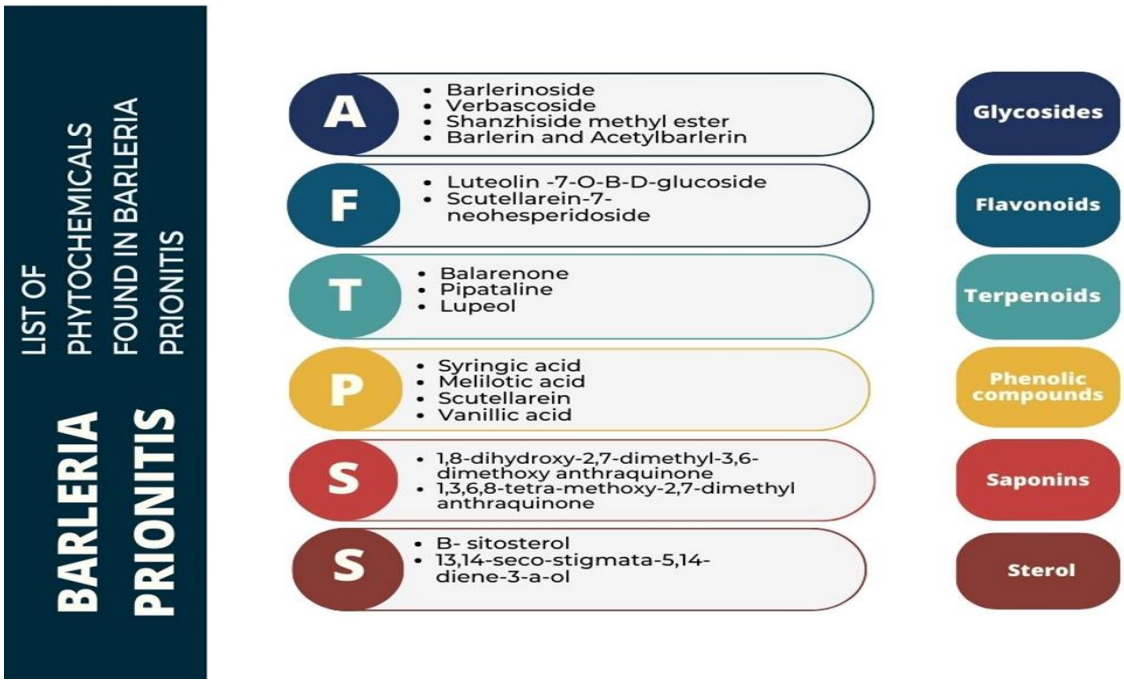

Figure 2: List of phytochemicals found in *Barleria prionitis*.

Some recently added compounds to the profile of *Barleria prionitis*-

1) Glycosides –

- 6-O-trans-p-coumaroyl-8-o-acetyl-shanzhiside methyl ester[9]
- Lupulinoside

2) Anthraquinones -

- 1,8,dihydroxy-2,7-dimethyl-3,6-dimethoxy anthraquinone[10]
- 1,3,6,8-tetra methoxy-2,7-dimethyl anthraquinone

3) Flavonoid –

- Apigenin 7-O-glucoside [6]

Therapeutic properties of *Barleria prionitis* (Figure 3) –

1. Anti-viral activity- According to certain research, *Barleria prionitis* extracts have antiviral qualities. These investigations frequently concentrate on the plant's ability to combat specific viruses in lab environments like Respiratory syncytial virus. Research conducted in vitro shows that *Barleria prionitis* extract has inhibitory effects against the respiratory syncytial virus (RSV) was demonstrated by isolated iridoid glycosides [9].

2. Anti-inflammatory activity - It is thought that *Barleria prionitis* which has been used medicinally for centuries, possesses anti-inflammatory qualities [3]. Numerous research works have examined its perspective in this context. Its extracts may have anti-inflammatory properties, according to certain laboratory research conducted on animal models. In which animals are often given extracts to inject after being made inflammatory and a reduction in marker molecules of inflammation is seen.

Bioactive Compounds: Flavonoids and phenolic substances that were extracted from *Barleria prionitis* are recognized for their ability to reduce inflammation. The plant's purported ability to alleviate inflammation related to these chemicals.

Barleria prionitis status as a natural anti-inflammatory is bolstered by the fact that it has been utilized in traditional medical systems such as Ayurveda to treat inflammatory diseases.

3. Impotence activity – Studies show that after 60 days of treatment with root methanolic extract, spermatogenesis significantly decreased (33.4%) without altering the overall metabolism of the body. Seminal vesicular fructose, spermatogenic cells including principal spermatocytes with secondary spermatocytes, and the number of spherical spermatids drastically decreased. Research conducted on rats demonstrates that methanolic extract of root given in therapy (100 mg/day) decreased the male rats' fecundity by 100% by decreasing Sertoli, spermatocytes, and spermatids developed Leydig cells as well as additional reproductive elements which led to the anti-spermatogenic ability of *Barleria prionitis* [6].

4. Immuno-protective - Both in vivo and in vitro, the iridoid fraction of *B. prionitis*, which primarily contained shanzhiside methyl ester and barlerin, triggered both specific and non-specific immunological responses. The nitroblue tetrazolium (NBT) test and the neutrophil candidacidal assay were used to examine the in vitro immunomodulatory action. The results showed a significant increase in the intracellular killing activity of activated neutrophils. There was a dose-dependent increase in the antibody titers and an increase in the delayed-type hypersensitivity reaction that sheep red blood cells caused in mice. Oral administration of the iridoid fraction of *B. prionitis* was used[11]. The humoral immune response was heightened as a result. Additionally, there was an increase in hemoglobin concentration, total white blood cell count, platelet count, red blood cell amelioration, and macrophage phagocytic activity. The myelosuppressive effects of cyclophosphamide were restored. Additionally, it demonstrated a significant rise in the percentage of neutrophils and their adherence to nylon fibers.

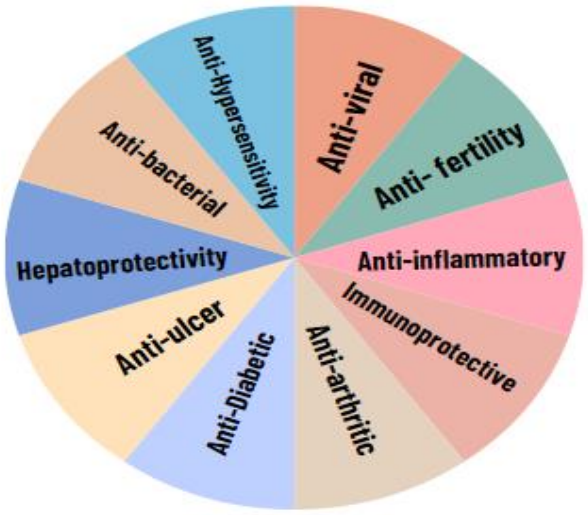

Figure 3: Therapeutic properties of *Barleria prionitis*

5. Anti-hypersensitivity - Male albino Wistar rats that had undergone uni-nephrectomy were used in a study to assess the antihypertensive effect. Rats were split into five groups, given varying doses twice a week for six weeks

then given 1% NaCl to drink in place of water to cause hypertension through injection of deoxycorticosterone acetate salt. Out of all the dose levels, 200 mg/BW and 400 mg/BW demonstrated the strongest antihypertensive effects [6]. Phytochemical screens indicated the presence of flavonoids, alkaloids, steroids, tannins, saponins, and phenolic compounds in *B. prionitis*, all of which had significant antihypertensive effects.

6. Hepatoprotective activity - It was discovered during a study that the iridoid-enriched fraction from the ethanol-water extract of *B. prionitis'* leaves and stems significantly protects the liver against the hepatotoxic effects of paracetamol, galactosamine, and carbon tetrachloride. The typical medication used was silymarin. In research carried out on mice with experimental liver injury, the majority of the altered hepatic parameters were restored by the iridoid-enriched fraction of the respective plant [11].

7. Anti-diabetic - In rats with diabetes caused by alloxan, an alcoholic leaf extract (200 mg/kg) raised insulin (130%) and liver glycogen (96.68%) while lowering glycosylated hemoglobin (22%) in the rats. In the same rat model, alcoholic root extract at the same dose increased insulin (30%) and liver glycogen (46.40%) but decreased glycosylated hemoglobin (11%). After 7 days of therapy, the blood glucose level was lowered to 82.39±0.95 and 92.52±2.88 and 73.68±1.83 mg/100 ml by alcoholic, aqueous leaf extract (200 mg/kg) and chlorpropamide (100 mg/kg) in an alloxan-induced diabetic rat model. The initial values were 299.72±3.97, 233.59±3.49, and 274.93±6.7 mg/100 ml. After seven days of treatment, the aqueous and alcoholic extracts of the root decreased to 94.56±2.04 and 74.12±1.13 mg/100 ml, respectively, from starting values of 240.59±1.62 and 247.68±4.83 mg/100 ml in the same rat model [6].

8. Anti-ulcer activity - Experimental in-vivo models were utilized to investigate the gastro-protective properties of *B. prionitis* leaf chloroform extract. Non-steroidal anti-inflammatory medications and pylorus ligation both caused ulcers. Using the pylorus ligation model, the parameters of gastric secretion (volume, pH, total protein, and free and total acidity) were ascertained. The findings demonstrated that the ethyl acetate fraction and chloroform extract inhibited the stomach ulcers brought on by indomethacin. Gastric secretion in rats with pylorus ligation was reduced by the ethyl acetate fraction. The outcome demonstrated that *Barleria prionitis* leaf chloroform extract has antiulcer action, hence confirming the plant's traditional use in treating gastric ulcers[12].

9. Anti-arthritic - The anti-arthritic properties of ethyl acetate fractions of chloroform extract from *Barleria prionitis* leaves were investigated in rats with acute non-immune arthritis generated by formaldehyde and chronic immunological arthritis induced by Freund's Complete Adjuvant. Both acute and chronic models showed dose-dependent and substantial suppression of edema. The results of body weight, metabolic parameters, motor coordination, and nociceptive threshold in Freund's Complete Adjuvant-induced arthritic model corroborate the extract's most powerful and profound paw edema inhibition. In a formaldehyde-induced arthritis model, the ethyl acetate fraction (125 and 250 mg/kg) of leaf dramatically reduced joint swelling after 8 to 10 days of dosing[13]. In a rat model of FCA-induced arthritis, it also significantly reduced the amount of arthritic score with weight gain.

10. Anti-bacterial activity - The antibacterial efficacy of *Barleria prionitis* bark extracts including acetone, methanol, ethanol, and aqueous extracts were tested in vitro against four oral bacteria: Streptococcus mutans, Staphylococcus aureus, Pseudomonas sp., and Bacillus sp. The antibacterial activity of *B. prionitis* bark against

Bacillus sp. was shown to be on par with that of ciprofloxacin, a common antibiotic. The analysis illustrated that Chloroform, ethanol, and petroleum ether extract of *B.prionitis* exhibited comparatively strong antibacterial activity against a range of bacterial species[14]. The plant's numerous extracts were first made according to different concentration levels, and after that, they were thoroughly tested on a variety of bacterial growth media to find the minimal inhibitory concentration. These extracts showed notable antibacterial activity. Local people utilize the leaf juices of *Barleria prionitis* to cure oral conditions such as mouth ulcers, pyorrhea, dental caries, and gum disease. The ethanolic extract exhibited more antibacterial activity than the aqueous extract, as demonstrated by the zone of inhibition and minimum inhibitory concentration of all the extracts.

SWOT Analysis -

STRENGTH	WEAKNESS
Barleria prionitis is positioned as a valuable source of natural medicine due to its richness in bioactive chemicals with a varied range of curative properties.	Standardized formulations for pharmaceutical usage and few clinical trials emphasize the need for more investigation and advancement.

Current conservation status of *Barleria prionitis* -

The International Union for Conservation of Nature (IUCN) often classifies it as "Least Concern" in terms of conservation status.

The species is widely distributed throughout several continents including portions of Asia, Australia, and Africa. It is frequently found in a variety of environments including disturbed regions, arid plains, and forest borders while its conservation status depends upon many factors such as habitat loss, over-exploitation, invasive species, climate change, pollution, disease and pests, genetic factors, and legal protection etc...

An evaluation of these variables assists in the determination of a plant species' conservation status, as indicated by the International Union for Conservation of Nature (IUCN) Red List categories - least concern, near threatened, vulnerable, endangered, or severely endangered.

PUBLIC HEALTH and POLICY CONSIDERATION –

Public Awareness

Increasing knowledge about *Barleria prionitis* therapeutic potential as well as its significance for public health, encourages critical thinking and healthcare literacy.

Policy Advocacy

Advocating for laws that ensure equal access to a range of healthcare options by recognizing and incorporating traditional medicine into national healthcare systems.

Three Acts currently govern the use of medicinal plants in India. These are the Wildlife (Protection) Act of 1972 (WLPA), the Forest (Conservation) Act of 1980, and the Indian Forest Act (IFA) which established the Forest Produce Transit Rules that govern the export of wild-collected medicinal plants.

To support policies and programs for the expansion of trade, cultivation, conservation, and exportation of medicinal plants, the Indian government formed the National Medicinal Plants Board (NMPB). The NMPB encourages the trade, study and development, sustainable use, and production of medicinal plants. The growth of India's medicinal plant industry has been significantly aided by NMPB. Farmers can receive financial assistance from NMPB to grow therapeutic plants.

For MPCDS, the Center offers 100% support or an amount of Rs. 20,000 per hectare. The Medicinal Plants Conservation Area (MPCA), which was earlier recognized and developed under the NMPB is to be strengthened with funding of Rs. 5,000 per acre.

Biological Diversity Act, 2023 - Both Houses of Parliament passed the Biological Diversity (Amendment) Bill, 2023 during the Monsoon Session of Parliament in 2023.

This bill aims to –

(i) encourage the cultivation of medicinal plants to lessen the pressure on wild medicinal plants;

(ii) support the Indian medical system

(iii) expedite the process of applying for patents, conducting research, and transferring research results while utilizing India's biological resources without jeopardizing the goals of the United Nations Convention on Biological Diversity and its Nagoya Protocol.

References –

[1] S. Banerjee, S. Banerjee, G. K. Jha and S. Bose, "Barleria prionitis L.: An Illustrative Traditional, Phytochemical and Pharmacological Review," *Nat. Prod. J.*, vol. 11, no. 3, pp. 258–274, 2020, doi: 10.2174/2210315510666200131114525.

[2] S. O. Amoo, A. R. Ndhlala, J. F. Finnie and J. Van Staden, "Antifungal, acetylcholinesterase inhibition, antioxidant and phytochemical properties of three Barleria species," *South African J. Bot.*, vol. 77, no. 2, pp. 435–445, 2011, doi: 10.1016/j.sajb.2010.11.002.

[3] M. M. Lekhak, S. S. Patil, P. V. Deshmukh, U. M. Lekhak, V. Kumar and A. Rastogi, "Genus Barleria L. (Acanthaceae): a review of its taxonomy, cytogenetics, phytochemistry and pharmacological potential," *J. Pharm. Pharmacol.*, vol. 74, no. 6, pp. 812–842, 2022, doi: 10.1093/jpp/rgab183.

[4] K. Singh, D. Sharma and R. S. Gupta, "A Comprehensive review on Barleria prionitis (L.)," *Asian J. Pharm. Clin. Res.*, vol. 10, no. 12, pp. 22–29, 2017, doi: 10.22159/ajpcr.2017.v10i12.18587.

[5] S. M. Shendage and S. R. Yadav, "Revision of the genus Barleria (Acanthaceae) in India," *Rheedea*, vol. 20, no. 2, pp. 81–130, 2010.

[6] Mrs. Priyanka Namdeo, "Phcog Rev.: Plant Review Phyto-Pharmacology of Barleria Prionitis Linn. - a Review," *Indo Am. J. Pharm. Res.*, vol. 11, no. 1, pp. 1544–1551, 2021, doi: 10.5281/zenodo.453688.

[7] P. D. Diwan and Y. A. Gadhikar, "Assessment of phytochemical composition and antibacterial activity of

different extracts of Barleria prionitis leaves against oral microflora to improve dental hygiene," *Asian J. Pharm. Clin. Res.*, vol. 5, no. SUPPL 2, pp. 182–184, 2012.

[8] S. Talukdar, M. Rahman and S. Paul, "A Review on Barleria prionitis: Its Pharmacognosy, Phytochemicals and Traditional Use," *J. Adv. Med. Pharm. Sci.*, vol. 4, no. 4, pp. 1–13, 2015, doi: 10.9734/jamps/2015/20551.

[9] J. L. Chen Jian Lu Chen, Phillipe Blanc, Cheryl A. Stoddart, Mark Bogan, Edward J. Rozhon, Nigel Parkinson, Zhijun Ye, Raymond Cooper, Michael Balick, Weerachai Nanakorn and Michael R. Kernan, "New iridoids from the medicinal plant Barleria prionitis with potent activity against respiratory syncytial virus," *J. Nat. Prod.*, vol. 61, no. 10, pp. 1295–1297, 1998, doi: 10.1021/np980086y.

[10] S. B. Musale, V. A. Jagtap, M. S. Patil, K. P. Chittam and K. P. Wagh, "Diuretic activity of Barleria prionitis Linn Flower extract," *Int. J. Drug Discov. Herb. Res.*, vol. 1, no. 1, pp. 20–21, 2011.

[11] M. Siddiqui, "Phytochemical Analysis of Some Medicinal Plants," *Liaquat Med. Res. J.*, vol. 3, no. 8, pp. 1–5, 2021, doi: 10.38106/lmrj.2021.36.

[12] M. J. Balkwill and K. Balkwill, "A preliminary analysis of distribution patterns in a large, pantropical genus, Barleria L. (Acanthaceae)," *J. Biogeogr.*, vol. 25, no. 1, pp. 95–110, 1998, doi: 10.1046/j.1365-2699.1998.251120.x.

[13] "pharmacolgy of barleria cristata and prionitis.pdf."

[14] S. Afzal, Hafiz Ishfaq Ahmad, Abdul Jabbar, Mahmoud M. Tolba, Sameh AbouZid, Nimra Irm, Farheen Zulfiqar, Muhammad Zahid Iqbal, Shoaib Ahmad, Zubair Aslam "Use of Medicinal Plants for Respiratory Diseases in Bahawalpur, Pakistan," *Biomed Res. Int.*, vol. 2021, 2021, doi: 10.1155/2021/5578914.