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A Review on *Barleria prionitis*: Its Pharmacognosy, Phytochemicals and Traditional Use

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Authors' contributions

This work was carried out in collaboration between all authors. Author SNT designed the study and wrote the protocol. Author MBR wrote the first draft of the manuscript and analyses of the study. Author SP managed the literature searches and identified the species of plant. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Barleria prionitis, belonging to Acanthaceae family, is a small spiny shrub, normally familiar as "porcupine flower" with a number of vernacular names. It is an indigenous plant of South Asia and certain regions of Africa. The therapeutical use of its flower, root, stem, leaf and in certain cases entire plant against numerous disorders including fever, cough, jaundice, severe pain are recognized by ayurvedic and other traditional systems. As a significant source of secondary metabolites including saponin, tannin, flavonoid, alkaloid, glycoside, phenolic compounds recent pharmacognostical screening renders its effectual functions as potent antioxidant, anti-microbial, anti-inflammatory, hepatoprotective, gastro-protective agent etc. Although having a potential remedial significance, it is still underutilized. This review can be considered as a bird's eye view highlighting the current progress of *Barleria prionitis* in pharmacological and pharmacognostical field with its prominent folk uses.

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Keywords: Barleria prionitis; traditional use; pharmacognosy; phytochemicals.

ABBREVIATIONS

µg : microgram
µm : micrometer
hr : hour
kg : kilogram
mg : milligram
mm : millimeter
ml : milliliter
ABTS : 2,2´-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid)
AchE : Acetylcholinesterase
BP : Barleria prionitis
bw : Body weight
CNS : Central Nervous system
CRS : Cold-restraint stress
DOCA : Deoxycorticosterone acetate
DPPH : 1, 1- Diphenyl- 2- picrylhydrazyl
EC_{50} : Median effective concentration
FCA : Freund's Complete Adjuvant agent
GST : Glutathione S-transferase
Hg : Mercury
HPLC : High-performance liquid chromatography
IC_{50} : Half maximal inhibitory concentration
LD_{50} : Median lethal dose
MIC : Minimum inhibitory concentration
NMR : Nuclear magnetic resonance
OECD : Organization for Economic Co-operation & Development
PL : Pylorus ligation

1. INTRODUCTION

Barleria prionitis, a perennial, acanthaceous, barbed, bushy medicinal plant, including in Barleria genus containing 300 species is famous for its medicinal value from ancient time [1]. Extensively found in India, it is distributed widely in throughout Asia including Malaysia, Pakistan, Philippines, Sri Lanka, Bangladesh, Yemen and tropical Africa [2,3]. Commonly known as yellow nail dye plant in English, as a medicinal plant, it has numerous vernacular name in ayurvedic, sidda, unani and other traditional systems as sahachara, baana, kurantaka, kuranta, koranda, korandaka, shairiya, pita-saireyaka, piyaabaasaa, jhinti and katsaraiyaa, piyaabaansaa, chemmulli [4,5]. The whole plant is small in appearance, about 1-3 feet long and its flowers are equally broad as well as tubular, mainly yellowish or whitish, approximately 3-4 cm in length. Its fruits are ovoid and capsular whereas its seeds are flattened, covered with matted hairs, about 8 mm long and 5 mm wide. Its elliptic leaf containing 5-20 mm long spines is about 3-10 cm long and 1.5-4 cm broad. Its light tan or gray colored stems are stiff, round, cylindrical and glabrous [6,7]. As a significant source of several phytochemicals, recent pharmacological and pharmacognostical research of *Barleria prionitis* expose huge curative potential against several diseases which are recapitulated in this review along with its noteworthy ethnobotanical use.

Fig. 1. Whole plant of *Barleria prionitis* (Left) and its flower with leaves (Right)

Photo credit: http://www.uniprot.org/taxonomy/4189, https://commons.wikimedia.org/wiki/File:Barleria_prionitis_%28Porcupine_flower%29_in_Hyderabad,_AP_W_IMG_9993.jpg

2. TRDITIONAL USE OF *Barleria prionitis*

Ethano-medicinal practitioners used *Barleria prionitis* since ancient time for curing many harmful diseases or intolerable disorders. Its leaf is very gainful for the treatment of cough, irritation, stiffness of limbs, cold, cataract, enlargement of scrotum and sciatica [8-11]. Leaf juice is efficacious as remedy of catarrhal affections, dropsy, gastric problems, pus in ears, whooping cough, glandular swellings and boils [12-15]. For skin disease and wound, crushed leaf is given to skin [13,16,17]. Leaf paste is also very beneficial for curing scabies and toothache [6,12,18]. In case of fever, decoction of leaf extract with honey is given for 7 days [19]. In leucoderma, its ash also applied with butter [6]. Traditional physicians give advice to swallow (chew) it for mouth ulcers management [18]. Prepared oil from whole plant is applied externally during acute stage of cyst in blood vessels [20,21]. Whole plant also utilized as remedy for curing different diseases such as whooping cough, asthma, gout, respiratory problem, toothache and pyorrhea [14,18,22,23]. Oil extract of the plant is recommended for arresting greying of hair according to the ayurvedic pharmacopoeia of India [4]. Equal part of plant is mixed with *Ecbolium linneanun Kurz.* (Nilaambari), Shveta Sahachara and *Justica betonica* Linn. used for the treatment gout and dysuria [4]. In dropsy and liver congestion, powder form of stem with cow milk is taken as medication [6,24]. 4g plant powder mixed with Nimbuka Swarasa and given twice a day for 10 days in case of tonsillitis [25]. Root powder is directly used in case of fever [26]. Paste form of root is directly applied in boils and glandular swellings whereas paste with goat milk is given in rheumatic fever [6,10]. Root extract is given locally on skin to expel out spine from the skin and its decoction is taken orally for treatment of snakebite [27,28]. In viral fever, flower is efficacious [22]. Paste form is taken daily once for edema [18]. In case of whooping cough, prepared tablets (burned in an airtight earthen pot, heated until fine powder is obtained and then mixed with garlic juice) from green shoots and even roots mixed with honey are given one per day [6]. A brief summary of traditional use of BP are given in Table 1.

Table 1. Traditional use of *Barleria prionitis*

Plants part	Disorder/Disorder	Application mode	References
Leaf	Skin diseases	crushed leaf is given to skin	[13]
	Scabies	paste form of fresh leaf	[6]
	Cough and cold	not specified	[8,9]
	Pus in ears	applied as extract	[14]
	Catarrhal affections of children	juice directly applied	[12]
	Irritation and stiffness of limbs	not specified	[10]
	Glandular swellings and boils	given as juice directly	[12]
	Fever	decoction with honey for seven days to cure	[19]
	Whooping cough	juice form or decoction is given	[12,15]
	Leucoderma	leaf ash with butter	[6]
	Wound	crushed form directly applied	[16,17]
	Enlarged scrotum and sciatica	not specified	[10]
	Dropsy	directly as juice	[12]
	Gastric problems	juice obtained from macerated	[13]
	Cataract	not specified	[11]
	Toothache	paste or juice form is applied over the affected area	[12,18]
	Mouth ulcers	chewed and sap is swallowed	[18]
Whole plant	Cyst	prepared oil is used externally	[20,21]
	Whooping cough	dried plant is used	[22]
	Gout	paste is applied externally as an ointment	[18]

Plants part	Disorder/Disorder	Application mode	References
	Dysuria	used by formulation	[4]
	Respiratory problem	not specified	[23]
	Toothache	plant decoction	[14]
	Pyorrhoea	plant decoction	[14]
	Bronchial asthma	mixed with honey	[4]
	Tonsillitis	applied by formulation	[25]
	Greying of hair	oil extract is given	[4]
Stem	Dropsy and liver congestion	powder with cow milk	[6]
	Dropsy	juice of bark directly	[24]
Root	Fever	directly powder is taken to cure	[26]
	Boils and glandular swellings	paste form is directly applied	[10]
	Rheumatic fever	paste with goat milk is given	[6]
	Jaundice	not specified	[4,29]
	Snakebite	decoction is taken orally	[27]
	Expel out spine	extract is applied locally on skin	[28]
	Whooping cough	used as formulation	[6]
Flower	Viral fever	not specified	[22]
Seed	Edema	paste is taken daily once	[18]
Shoot	Asthma	used by formulation	[6]
	Whooping cough	prepared tablets with honey	[6,29]

3. PHYTOCHEMICAL ASSESSMENT OF *Barleria prionitis*

For the presence of efficacious secondary metabolites, it is not only economical for plant itself but also beneficial for better health of us. Scientists are already isolated and characterized phytochemicals such as alkaloid, flavonoids, saponins, tannin, steroid, terpenoids, sterol (stigmasterol), phenolic compound and essential oil from its leaf by different qualitative tests [30-33]. It's arial parts contains a large quantities of glycosides (6-o-trans-p-coumaroyl-8-o-acetylshanzhiside methyl ester, barlerinoside, shanzhiside methyl ester, 6-o-trans-p-coumaroyl-8-o-acetylshanzhiside methyl ester, barlerin, acetylbarlerin, 7-methoxydiderroside, and lupulinoside), terpenoid (lupeol), pipataline, balarenone and 13,14-seco-stigmasta-5,14-diene-3-ol identified by NMR [34-37]. Large amount of secondary metabolites such as glycosides, saponins, flavonoids, phenolic compounds, tannins, alkaloids, phytosterols, polyphenol and steroids are present in whole plant detected by different phytochemical tests [38-40]. Flowers contains significant phytochemicals including flavonoid, glycoside and neohesperidoside [4]. New compounds such as hydroxy-2, 7-dimethyl-3, 6-dimethoxy anthraquinone, 1,3,6,8-tetra methoxy-2,7-dimethyl anthraquinone and 7-rhamnosylglucoside are isolated from *Barleria prionitis* [41,42]. A brief summary of phytochemical study are given Table 2.

4. PHARMACOGNOSTICAL PROPERTIES OF *Barleria prionitis*

A brief summary of pharmacognostical properties are given Table 3.

4.1 Anti-helmintic Activity

Ethanolic and aqueous extracts of whole plant exhibited paralysis in lower doses (50, 75 and 100 mg/ml) and also triggered death at higher concentration of 100 mg/ml against *Pheretima posthuma* worms [44].

4.2 Anti-arthritic Activity

Ethyl acetate fraction (125 and 250 mg/kg) of leaf significantly suppressed the joint swelling after 8-10 days administration in formaldehyde induced arthritis model and it also decreased significant level of arthritic score with weight gain in FCA-induced arthritis rat model [31,45].

Table 2. Phytochemical composition of *Barleria prionitis*

Plants part	Phytochemical/Nutrient	Test (extract details)	References
Leaf	Alkaloid	TLC (ME)	[30,31,33]
	Flavonoids	TLC (ME)	
	Saponins	TLC (ME)	
	Tannin	TLC (ME)	
	Phytosteroids	TLC (ME)	
	Phenolic compound	TLC (ME)	
	Terpenoids	Not Specified	[31]
	Sterol (stigmasterol)	HPLC	
	Essential oil	Not specified	[32]
Aerial part	Glycosides	NMR	[34-36]
	Terpenoid (lupeol)	NMR (EE)	[37]
	Pipataline, Balarenone, 13,14-Seco-stigmasta-5,14-diene-3-ol	NMR (EE)	
Whole plant	Glycosides	Borntrager's test (HE, ME, EE), Legal's test (HE, ME, EE)	[38-40]
	Saponins	Frothing test (HE, ME, EE, AqE)	
	Flavonoids	Ammonia test (HE), Alkaline reagent test (ME, CE, AqE), Shinoda test (CE, ME, AqE)	
	Phenolic compounds and Tannins	$FeCl_3$ test (HE, AqE, ME, EE), Lead acetate test (ME, EE, AqE), Bromine water test (ME, AqE, EE)	
	Steroids	Salkowski test (HE)	[38]
	Alkaloids	Mayer's reagent (PeE, ME, EE), Hager's reagent (PeE), Wagner's reagent (PeE, ME, EE), Dragendorff's reagent (PeE, ME,EE)	[39,40]
	Carbohydrate	Molisch test (ME, EE), Fehling's solution (ME, EE), Fehling's solution B (ME, EE), Benedict's test (ME, EE)	
	Phytosterols	Liebermann's test (ME, AqE), Libermann Burchard test (ME, AqE)	
	Proteins and amino acid	Biuret test (ME, EE), Ninhydrin test (ME, EE)	
	Polyphenol	Folin-ciocalteu test (EE, AqE)	[43]
	7-rhamnosylglucoside	Not specified	[42]
	Anthraquinones	Chemical tests	[41]
Flower	Flavonoid	Not specified	[4]
	Glycoside	Not specified	
	Neohesperidoside	Not specified	

Hydroalcoholic extract = HE, Ethanolic extract = EE, Methanol extract = ME, Chloroform extract = CE, Aqueous extract = AqE, Pet ether extract = PeE

4.3 Antibacterial Activity

Acetone, ethanol, methanol extract of bark and ciprofloxacin showed significant activity against *Streptococcus mutans* (14.95±1, 11.94±1, 15.65±0.57 and 27.32±0.57 mm), *Staphylococcus aureus* (14.31±0.57, 14.0±0, 16.32±0.57 and 34.66±0.57 mm), *Pseudomonas sp.* (18.32±0.57, 17.65±0.57, 19.32±0.57 and 33.66±0.57 mm) and *Bacillus sp.* (27.32±0.57, 23.97±1, 28.65±0.57 and 29.65±0.57 mm) in well diffusion method [46]. Lowest MIC was found to be 5 mg/ml for chloroform extract of leaf against *Salmonella typhi, Bacilus subtilis, Vibrio cholera-813, Micrococcus luteus* and *Citrobacter.* On the other hand petroleum ether and ethanol extract of leaf showed 3.33 and 10 mg/ml against *Bacilus subtilis* in MIC method [47]. Petroleum

ether, chloroform and 70% ethanol extract of leaf displayed least MIC as 3.33 mg/dl (against *Salmonella typhi* Ty 2-59, *Bacilus cereus* PI-11778, *Vibrio cholerae* DN-6, *Providencia, Lactobacillus sporogenus* and *Citrobacter* 8307), 5mg/dl (against *Bacilus cereus* PI-11778, *Vibrio cholera* DN-6 and *Providencia*) and 10mg/dl (against *Salmonella typhi* Ty 2-59, *Bacilus cereus* PI-11778, *Vibrio cholera* DN-6, *Providencia*, *Lactobacillus sporogenus* and *Citrobacter* 8307), respectively [48]. Aqueous, petroleum, chloroform and acetone extract of leaf provided highest inhibition zone (5, 5, 10 and 10 mm) against *Lactobacillus rhamnosus* [30]. Comparative study showed good MIC against *Salmonella typhi, Bacillus subtilis, Staphylococcus aureus, Vibrio cholera, E. coli* by pet ether extract (6.66, 3.33, 3.33, 6.66 and 16.16 mg/ml, respectively), chloroform extract (5, 0, 5, 25 and 5 mg/ml, serially), ethanol extract (20, 0, 10, 100 and 10 mg/ml, sequentially), aqueous extract (50, 0, 50, 100 and 10 mg/ml, respectively) and column fraction (5, 5, 25, 5 and 5 mg/ml, individually) [40].

4.4 Anticancer Activity

Methanol extracts of leaf were found to be inactive [49].

4.5 Antidiabetic Activity

Alcoholic extract of leaf (200 mg/kg) increased insulin (130%) and liver glycogen (96.68%) and decreased glycosylated hemoglobin (22%) in alloxan-induced diabetic rats. Alcoholic extract of root at same dose increased insulin (30%) and liver glycogen (46.40%) whereas decreased glycosylated hemoglobin (11%) in same rat model [50-52]. Alcoholic, aqueous extracts of leaf (200 mg/kg) and chlorpropamide (100 mg/kg) reduced blood glucose level as 82.39±0.95 and 92.52±2.88 and 73.68±1.83 mg/100 ml after 7 days treatment where initial values were 299.72±3.97, 233.59±3.49 and 274.93±6.7 mg / 100 ml in alloxan induced diabetic rat model. Aqueous and alcoholic extracts of root reduced as 94.56±2.04 and 74.12±1.13 mg/100 ml after 7 days treatment where initial values were 240.59±1.62 and 247.68±4.83 mg/100 ml in same rat model [53].

4.6 Antifertility Activity

Treatment of 100 mg/kg of isolated fractions of root methanolic extract for 60 days showed a significant reduction on spermatogenesis without affecting general body metabolism where fertility (33.4%), seminal vesicular fructose and spermatogenic cells such as primary spermatocytes, secondary spermatocytes and round spermatids were declined significantly [54, 55]. Treatment of root extract (100 mg/rat/day) reduced the fertility of male rats by 100% by decreasing spermatids, spermatocytes, sertoli cells, mature leydig cell and other reproductive factors [56]. It also showed anti-spermaogenic activity [57-59].

4.7 Antifungal Activity

Acetone, ethanol, methanol extract of bark and amphotericin-B showed significant activity respectively against *Saccharomyces cerevisiae (*11.64±0.57, 11.31±0.57, 13.95±1 and 11.94±1 mm), *Candida albicans* strain1 (13.65±0.57, 12.94±1, 15.31±0.57 and 13±0 mm) and *C. albicans* strain 2 (16±0, 11.31±0.57, 16.96±1 and 12.94±1 mm) in well diffusion method [46].

4.8 Anti-hypertensive Activity

Enalapril, methanolic extracts at 200 and 400 mg/bw of leaf possessed antihypertensive effect as 136.5±2.51, 146±2.21 and 143±3.11 mm Hg on systolic blood pressure and 103±2.54, 100.5±2.74 and 105.5±2.35 mm Hg diastolic blood pressure after six weeks treatment [60] .

4.9 Anti-inflammatory Activity

Ethanol extract of flower and phenylbutazone showed 48.6 and 57.5% inhibition in carrageenin-induced paw edema in rat model. Extarct at 50, 100 and 200 mg/kg decreased granuloma weight from 15.32 to 36.4% gradually where phenylbutazone exposed 36.1% inhibition in cotton pellet granuloma rat model [61]. Aqueous extract of root showed significant percentage inhibition of rat paw edema (52.56% & 55.76%) at a dose of 200 & 400 mg/kg respectively after 4 hr treatment [62]. Hydro-alcoholic extract whole plant (10 µg/ml) reduced rat mesenteric mast cells degranulation up to 64.91% and prevented hypotonic solution induced hemolysis of rat erythrocytes by 27.10% [38].

4.10 Anti-nociceptive Activity

Extract of flower (200 mg/kg) increased analgesio-meter-induced force and exhibited

resistance against pain. It also inhibited acetic acid induced pain as 30.6% where phenylbutazone (100 mg/kg) presented 34.6% [61].

4.11 Antioxidant and Free Radical Scavenging Activity

Isolated barlerinoside from aerial parts inhibited glutathione S-transferase with an IC_{50} value. Isolated shanzhiside methyl ester, 6-o-trans-p-coumaroyl-8-o-acetylshanzhiside methyl ester, barlerin, acetylbarlerin, 7-methoxydiderroside and lupulinoside also exhibited different levels of glutathione S-transferase, acetylcholinesterase inhibitory and free radical scavenging activities [35]. Whole plant displayed significant DPPH scavenging activity with significant IC_{50} values by butanol soluble fraction (26.46 µg/ml), ethyl acetate soluble fraction (25.22 µg/ml), chloroform soluble fraction (53.88 µg/ml), hexane soluble fraction (170.77 µg/ml), methanolic extract (110.79 µg/ml) and ascorbic acid (23.10 µg/ml) [39]. Highest DPPH scavenging activities were found to be 92.3, 61.97 and 70.59% by ascorbic acid (20 µg/ml), aqueous (100 µg/ml) and ethanolic extract (100 µg/ml) of whole plant in DPPH scavenging assay, respectively. Severally, 48.03, 63.18 and 74.99% inhibition activities were determined by ascorbic acid (35 µg/ml), aqueous (200 µg/ml) and ethanolic extract (200 µg/ml) in ABTS scavenging assay. Ascorbic acid (25 µg/ml), aqueous (50µg/ml) and ethanolic extract (50µg/ml) showed 50.71, 33.67 and 39.76% inhibition activities, respectively in hydroxyl radical scavenging assay. In reducing power assay, inhibition activities were found to be 0.7195, 0.1638 and 0.3025 by ascorbic acid (15 µg/ml), aqueous (250 µg/ml) and ethanolic extract (250 µg/ml), independently. Inhibitions were found to be 85.75, 65.29 and 71.14%, individually for ascorbic acid (500 µg/ml), aqueous (800 µg/ml) and ethanolic extract (800 µg/ml) in nitric oxide scavenging assay [40].

4.12 Antiviral Activity

Isolated iridoid glycosides revealed potent *in vitro* activity against respiratory syncytial virus (EC_{50} 2.46 was µg/ml and $IC_{50}$was 42.2 µg/ml) [34].

4.13 CNS Depressant Activity

Ethyl acetate fraction (125 and 250 mg/kg) and diclofenac (4 mg/kg) treatment significantly increased fall off time of motor co-ordination in rota rod test [31]. Etahnolic extract of leaf showed fluoxetine stimulant activity in mice as 91.93% whereas the test drug stimulated the animal only by 49.72% using acto-photometer [63].

4.14 Cytotoxic Activity

No toxic reaction seen up to dose of 2000 mg/kg [61]. LD_{50} was found to be more than 3000 mg/kg with no marks of abnormalities or any mortality observed in 15 days treatment [64].

4.15 Diuretic Activity

Aqueous root extract (100 mg/kg) produced significant diuresis (12.58±0.80 urine volume in 24 hr) compared with furosemide at 20 mg/kg (12.58±0.80 urine volume in 24 hr) and increased sodium elimination [65].

4.16 Enzyme Inhibitory Activity

Isolated balarenone, pataline, lupeol and 13,14-seco-stigmasta-5,14-diene-3-α-ol from ethanolic extract of BP exhibited inhibitory activity against GST (IC_{50} value was 160µg/ml). Derivative biochemical compound named 8-amino-7-hydroxypipataline exhibited AChE inhibitory activity where IC_{50} value was 36.8 µm [22,37].

4.17 Gastro-protective Activity

Maximum protections were found to be 66.26% and 59.42% by iridoid fraction (200 mg/kg) in PL-induced ulcer and CRS-induced ulcer rat model. Iridoid fraction from leaves reduced ulcer index [66]. In ethanol induced gastric ulcer rat model, methanolic extract of leaf (500 mg/kg bw) and ranitidine provided 67.7and 75.5% inhibition of ulcer. Same dose of extract and drug displayed 70.3 and 62.2% inhibition in indomethacin induced gastric ulcers model. Extract also showed efficacy against indomethacin induced gastric mucosal damage and increased liver enzymes in ethanol induced ulcer rat model [67].

4.18 Hepato-protective Activity

Isolated iridoid from ethanol-water extract of aerial parts (leaves and stems) afforded significant hepatoprotection against carbon tetrachloride, galactosamine and paracetamol induced hepatotoxicity [64].

4.19 Larvicidal Activity

LC_{50} values were found to be 34.756, 31.351 and 28.577 µg/ml in acetone, chloroform and methanol extract of leaf against *Culex tritaeniorhynchus*, respectively [33].

Table 3. Pharmacognostical properties of *Barleria prionitis*

Activity	Plants part	Extract	Brief summary	References
Anti-helmintic	Whole plant	Aqueous, Ethanolic	Exhibited paralysis in lower doses and triggered death at 100 mg/ml against *Pheretima posthuma*	[44]
Anti-arthritic	Leaf	Ethyl acetate	Fraction (125 and 250 mg/kg) treatment significantly suppressed the joint swelling in formaldehyde induced arthritis and decreased arthritic score with weight gain in FCA-induced arthritis rat model.	[31,45]
Anti bacterial	Bark	Acetone, Ethanol, Methanol	Extracts were highly active against *Bacillus* sp. in agar well diffusion method was compared with ciprofloxacin.	[46]
	Leaf	Pet. Ether, Chloroform, Ethanol	Least MIC was found to be 3.33 mg/ml by petroleum ether extract against *Bacilus subtilis*.	[47,48]
	Leaf	Aqueous, Petroleum, Chloroform, Acetone	Chloroform and acetone extract at 200 mg/ml showed 40% inhibitory activity against *Lactobacillus rhamnosus* in disc diffusion assay.	[30]
	Whole plant	Petroleum ether, Chloroform, Ethanol, Aqueous	Pet ether extract showed highest inhibition zone against *Bacillus subtilis* and *Staphylococcus aureus* in MIC method.	[40]
Anticancer	Leaf	Methanol	No any significant activity was found.	[49]
Antidiabetic	Leaf	Alcohol	At 200 mg/kg increased insulin (130%) and liver glycogen (96.68%) whereas decreased glycosylated hemoglobin (22 %) in alloxan-induced diabetic rats.	[50-52]
	Root Leaf	Alcohol Aqueous	Extracts (200 mg/kg) provided significant activity in alloxan-induced diabetic rat model.	[53]
Antifertility	Root	Methanol	Fraction treatment (100 mg/kg) showed a significant reduction on spermatogenesis where fertility was decreased 33.4%.	[54,55]
	Root	Not Specified	100 mg/ rat/ day reduced 100% fertility of male rats.	[56]
Antifungal	Bark	Acetone, Ethanol, Methanol	Extracts were highly active against *C. albicans* in agar well diffusion method while compared with amphotericin-B.	[46]
Anti-hyper Tensive	Leaf	Methanol	Possessed profound activity after six week treatment in DOCA induced hypertensive rat model	[60]
Anti-inflam matory	Flower	Ethanol	200 mg/kg revealed 48.6% and 36.4% inhibition in Carrageenin-induced paw edema and reduction in cotton pellet-induced granuloma in	[61]

Activity	Plants part	Extract	Brief summary	References
			rat model, respectively.	
	Root	Aqueous	200 & 400 mg/kg presented 52.56% & 55.76% inhibition of caragennan induced paw edema rat.	[62]
	Whole plant	Hydro alcohol	Extract (10µg/ml) reduced rat mesenteric mast cells degranulation up to 64.91% and prevented hypotonic solution induced hemolysis of rat erythrocytes by 27.10%.	[38]
Anti-nociceptive	Flower	Ethanol	200mg/kg increased analgesio-meter-induced force and pain resistance. Moreover it inhibited acetic acid induced pain as 30.6%.	[61]
Antioxidant and free radical scavenging	Aerial parts	Not specified	Presence of glycosides displayed significant free radical scavenging activities.	[35]
	Whole plant	Butanol, Ethylacetate, Chloroform, Hexane, Methanol	Ethyl acetate soluble fraction (75 µg/ml) and butanol soluble fraction (100 µg/ml) showed highest DPPH inhibition activity as 97.20 and 97.19%.	[39]
	Whole plant	Ethanol, Aqueous	IC_{50} of ethanolic and aqueous extract were found to be 65.58 and 77.40 µg/ml in DPPH scavenging assay, 114.23 and 135.92 µg/ml in ABTS scavenging assay, 59.76 and 70.55 µg/ml in Hydroxyl scavenging assay, 476.19 and 551.77µg/ml in Nitric oxide scavenging assay.	[43]
Antiviral	Not specified	Not specified	Isolated iridoid glycosides revealed potent activity against respiratory syncytial virus.	[34]
CNS depressant	Leaf	Ethyl acetate	Fraction (125 and 250 mg/kg) and diclofenac (4 mg/kg) significantly increased fall off time in rota rod test model.	[31]
	Leaf	Ethanol	Extract provided very significant activity as 91.93% compared with the fluoxetine stimulant drug (49.72%).	[63]
Cytotoxic	Flower	Ethanol	No toxicity was found up to 2000 mg/kg administration.	[61]
	Leaf and Stems	Ethanol, Aqueous	LD_{50} was found to be more than 3000 mg/kg with no marks of abnormalities or any mortality.	[64]
Diuretic	Flower	Aqueous	Produced significant diuresis and increased sodium elimination.	[65]
Enzyme Inhibitory	Not specified	Ethanol	Isolated biochemical compound exhibited GST and AchE inhibitory activity.	[22,37]
Gastro-protective	Leaf	Not specified	Maximum protections were found to be 66.26% and 59.42% in PL-induced and CRS-induced ulcer	[66]

Activity	Plants part	Extract	Brief summary	References
			in rat model.	
	Leaf	Methanol	At 500 mg/kg and ranitidine provided 67.7 and 75.5% inhibition in ethanol induced gastric ulcer and 70.3 and 62.2% inhibition in indomethacin induced gastric ulcer in rat model.	[67]
Hepato-protective	Leaf and stems	Ethanol Aqueous	Isolated iridoid afforded protection against carbon tetrachloride, galactosamine and paracetamol induced hepatotoxicity	[64]
Larvicidal	Leaf	Acetone, Chloroform, Methanol	LC_{50} values were found to be 34.756, 31.351 and 28.577 µg/ml in acetone, chloroform and methanol extract against *Culex tritaeniorhynchus*, respectively.	[33]

5. CONCLUSION

Due to the presence of curative properties, medicinal plants always have got special emphasis from prehistoric era and current outgrowth of pharmacological industry cannot ignore its dominance for its unique phytochemicals containing infinite potential against numerous diseases. Consequently, tremendous research efforts are required to justify their previous established role commonly used by local practitioners and identify novel pharmacological and pharmacognostical features. From this review it is conspicuous that several portions of *Barleria prionitis* individually or jointly administered successfully by traditional practitioners specifically against fever, severe pain, asthma, ulcer etc. Moreover, pharmacological assays identify its dominant role as anti-microbial, free radical scavenging, gastro-liver protective agent. But as an established medicinal plant, it is still underutilized and its huge potentials are still uncovered but significant presence of several new secondary metabolites strengthen the demand of further research based on its phytotherapeutical importance. Besides its numerous folk use, this review also illustrates its phytochemical profile as well as pharmacological augmentation which will be helpful for future researchers.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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