A COMPREHENSIVE REVIEW ON BARLERIA PRIONITIS (L.)

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ABSTRACT

Barleria prionitis is a famous perennial plant commonly known as porcupine flower or Vajaradanti. It is a shrub with yellow flowers and two flat seeds shielded with matted hairs, inhabit most parts of India. Various parts of the plant such as leaves, roots, aerial parts, flowers, and stems are used in the traditional system of medicine. Conventionally, various infusions are prepared using the plant parts and utilized for the treatment of different kinds of diseases. Due to its incredible odontalgic property, it is extensively used in treating bleeding gums and toothache. From the pharmacological point, the plant has been effectively screened for antibacterial, antifungal, antiviral, anti-inflammatory, anti-fertility, antioxidant, enzyme inhibitory, hepatoprotective, antihypertensive, anticancer, and antacid activities. Compounds such as tannins, saponins, glycosides, phenolic acids, phytosterols, and terpenes have been identified in the plant. The plant contains some specific compounds such as barlenoside, barlerine, acetylbarlerine, and balarenone and some common secondary metabolites such as lupeol, β-sitosterol, vanillic acid, and syringic acid. This review provides morphological, ethnomedical, pharmacological, and phytochemical data of the plant B. prionitis.

Keywords: Barleria prionitis, Odontalgic, Tannins, Saponins, Phytosterols, Ethnomedical, Pharmacological.

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INTRODUCTION

Barleria prionitis also known as the porcupine flower, which belongs to the family Acanthaceae and genus Barleria. It is native to India, also distributed widely throughout Asia including Malaysia, Pakistan, Philippines, Sri Lanka, Bangladesh, Yemen and tropical Africa [1,2] Sri Lanka and Eastern Southern and Central Africa. It is an erect, perennial, prickly, and evergreen shrub, usually single-stemmed, growing to about 1.5 m in height from a single taproot. Lateral roots branching in all directions. The leaves are up to 100 mm long and 40 mm wide, oval-shaped though narrow at both ends (ellipsoid). The base of the leaves is protected by three to five sharp, 10-20 mm long, pale-colored spines. The yellow-orange tubular flowers with several long protruding stamens. Flowers are packed in bunches tightly together at the top of the plant, but they also occur singly at the base of leaves. Seed capsule which is oval-shaped has two fairly large, flat seeds, shielded with matted hairs with a sharp pointed beak. Stems and branches are stiff and smooth and light brown to light gray in color [3,4]. The taxonomical classification of B. prionitis is given in Tables 1 and 2.

Scientific name - Barleria prionitis
Common name - Porcupine flower
HABITAT
B. prionitis is commonly found in shrub jungles and wayside thickets from plains to 500 m. Common. Tropical Africa, Tropical Asia, Sri Lanka, Pakistan, India, Malaysia. It is commonly found in the following states of India-Andaman and Nicobar Islands, Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, Udaipur Prades, and West Bengal [5].

RATIONALE AND NOVELTY OF THE STUDY

Ethnomedical information about B. prionitis
Family Acanthaceae consists of a large number of medicinal plants and is well known for its use in ethnomedicine. The prionitis species of the genus Barleria provides a variety of traditions properties. The whole plant or its specific parts (leaf, stem, root, bark, and flower) have been utilized for the treatment of catarrhal affections [6], ulcer, whooping cough, inflammations, glandular swellings, urinary infection, jaundice, fever, stomach disorders, and as diuretic and tonic. It is likewise used in urinary infection, jaundice, hepatic obstruction, and dropsy, and the paste of the roots is applied to benefit to boils and glandular swellings. It is also utilized for the treatment of anemia, toothache, and bacterial disorders. The flora is, especially, well recognized for caring for bleeding gums and toothache. Due to its antiodontalgic property, it is as well-known as “Vajaradanti” [7]. Some tribal communities utilize the leaves for the treatment of piles and to control irritation. The plant is also utilized for the stiffness of limbs, enlargement of the scrotum, and sciatica [8-11].

Pharmacological activities of B. prionitis
Owing to its traditional use, B. prionitis has been studied for different types of pharmacological activities. Numerous in vitro and in vivo studies on different cell lines and animals have been reported. The present review is focused on giving an overview of the pharmacological activities that have been reported on B. prionitis in the past and present.

Antibacterial activity
Different solvent extracts from leaves and stem parts of B. prionitis exhibited antibacterial activity against all Gram-positive bacteria studied (Bacillus pumilus, Bacillus subtilis, Streptococcus pyogenes, and Bacillus cereus) and Gram-negative bacteria (Escherichia coli, Serratia marcescens, Comamonas acidovorans, and Pseudomonas aeruginosa) [12]. Maximum inhibition was delivered by methanol leaf extract against B. cereus which was followed by pet ether leaf extract against E. coli. Minimum inhibition was shown by pet ether leaf extract against Alcaligenes faeacalis, followed by methanol bark extract against A. faeacalis. Antibacterial activity of the various extracts of B. prionitis was compared to the standard antibacterial agent ampicillin, tetracycline, and streptomycin, and it appeared to be almost the same [13]. In another study, the petroleum ether extract of B. prionitis was most dynamic against Pseudomonas putida and B. subtilis. While the ethanol extract of B. Prionitis was against P. putida [14]. Some antibacterial phytochemicals include balarenone, pipataline, and...
Kanakambar, Vajradanti, kat
Magnoliophyta
Scrophulariales
L. was given orally to
Vajradanti, Kurantaka, Koranta
Porcupine flower,
Manjakkanakambaram, Kanakambaram
Barleria
Araniyaccokicceti, manjachemulli, mirutam, mituri,
Magnoliopsida
was tested for their
Kalsunda, kholeta, pivalakoranta
4 hrs before the selenite
Prionitis
Acanthaceae
Plantae
exhibited that BS from the roots of
the dose level of 5 (Group
rats. The rats were orally administered olive oil (Group-I, control), BS at
Prionitis,
by this
effects of Barleria appeared to be arbitrated by conflicts in Leydig and
The methanolic root extract of
exhibited anthelmintic activity using
virus [18].
and shown to have potent
result revealed 40-85% inhibition of all of the species [17].
against some fungi such as
amphotericin-B [16]. In another investigation, the leaf exudates and leaf
strain 1, and
against the oral fungi such as Saccharomyces
Candidiasis and other oral infections, as its bark showed potent activity
The methanolic extract of
Antifungal activity
The methanolic extract of B. prionitis was considered to have a check on
Candidiasis and other oral infections, as its bark showed potent activity against
the oral fungi such as Saccharomyces cerevisiae, Candida albicans
strain 1, and C. albicans strain 2, when compared to the standard drug
amphotericin-B [16]. In another investigation, the leaf exudates and leaf
tissue sap of B. prionitis L. have been assessed for antifungal activities
against some fungi such as Curvularia lunata, Curvularia clavata,
Alternaria alternata, Nigrospora oryzae, and Cladosporium oxysporum.
The percentage inhibition of spore germination was calculated, and the result revealed 40-85% inhibition of all of the species [17].
Antiviral activity
Iridoid glycosides and three phenylpropanoid glycosides, namely, luteoside A, luteoside B, and luteoside C were isolated from B. prionitis
and shown to have potent in vitro activity against respiratory syncytial virus [18].
Anthelmintic activity
Aqueous and ethanolic extract of the whole plant of B. prionitis exhibited anthelmintic activity using Phorocera posthuma worms in a
dose-dependent manner giving the shortest time of paralysis (P) at 50, 75 mg/ml and death (D) with 100 mg/ml concentration when
compared to standard anthelmintic drug albendazole [19,20].
Antifertility activity
The methanolic root extract of B. prionitis L. was given orally to
male rats (100 mg/d). The duration of the study was 60 days, and
the extract reduced the fertility of male rats by 100%. Antifertility effects of Barleria appeared to be arbitrated by conflicts in Leydig and
Sertoli cells functions, resulting in the physiromorphological events of spermato genesis. [21] Antispermatogenic activity is also shown by this [22-24]. In another study done by us, an active component
β-sti stosterol (BS) was isolated from the methanolic root extract of B. prionitis, and its antifertility potential was evaluated in the male albino rats. The rats were orally administered olive oil (Group-I control), BS at
the dose level of 5 (Group II), 1.5 (Group III), and 2.5 mg/kg body weight
(BW) (Group IV) for 60 days. BW was measured weekly. The results
exhibited that BS from the roots of B. prionitis impairs spermatogenesis and fertility that recommends that BS from B. prionitis can be used for the development of the male contraceptive drug, which has very limited available options [25].
Antioxidant activity
The antioxidant capacity and the reducing power were found highest in the methanolic leaf and stem extract as inhibitory concentration
(IC50) values were 63.41±0.32 and 81.69±0.40, respectively. These results may be due to the presence of phenolic contents such as barlerins side, shanzhishide methyl ester, barliner, acetylbaltierin, 7-methoxydier ros ide, and lupulinoside [26]. In another study, antioxidant activity of various fractions of 90% methanol extract was determined using the 2,2-diphenyl-1-picrylhydrazyl (DPPH)
assay. The IC50 value of hexane, chloroform, ethyl acetate, and butanol soluble fractions of methanolic extract was calculated to
determine the DPPH radical scavenging property of these fractions, and ascorbic acid was taken as standard. The maximum effect
was demonstrated by the ethyl acetate soluble fractions among all. These methanolic extract fractions follow following order -
ethyl acetate > butanol > chloroform > methanol > hexane for their antioxidant activity [27]. Antioxidant activity of the ethanol extract and aqueous extract of the whole plant of B. prionitis was investigated in another study, and in this DPPH radical, 2,2’-azino bis(3-ethylbenzthiazoline-6-sulphonic acid) scavenging activity, hydroxyl radical scavenging activity, reducing power assay, and
nitrous oxide scavenging activity of various extracts of B. prionitis were calculated to evaluate the radical scavenging potential. Ethanol extract
was the more effective antioxidant as compared to the aqueous extract. A direct relationship can be concluded between the antioxidant activity and the phenolic content of B. prionitis [28], which
was determined using Folin–Gocaltieu reagent. Antioxidant activity was observed in some glycosides which have been isolated from the aerial parts of B. prionitis, namely, barlerinoside, shanzhishide methyl ester, 6-O-trans-p-coumararyl-8-O-acetylbaltzide methyl ester, barliner, acetylbaltierin, 7-methoxydierros ide, and lupulinoside [29].
Antidiabetic activity
Alcoholic extract of leaf and root of B. prionitis was tested for their anti diabetic activity in normal and alloxan-induced diabetic rats,
before and 2 weeks after administration of drugs. Effects demonstrated a significant reduction in blood glucose level and glycoxy lated hemoglobin. A significant increase was observed in serum insulin level and liver glycogen level whereas the decrease in the BW was
arrested by administration of a leaf extract to the animals. This work suggested that alcoholic leaf extract of B. prionitis could be considered
as one of the comparatively harmless and with fewer side effects herbal drug for the treatment of diabetes mellitus [30]. In another study, the
potency of alcoholic and aqueous extracts of leaf, stem, and root was compared with that of chlorpropamide at a dose of 200 and 100
mg/kg, respectively. The blood glucose level was measured calorimetrically. Alcoholic and aqueous extracts of leaf and root caused a significant fall in blood glucose level in diabetic rats. From this study, it was concluded
that B. prionitis is almost as effective as chlorpropamide in reducing the sugar levels [31].
Glutathione S-transferase, acetylcholinesterase inhibitory activity
A new compound, balarenone, along with three known compounds, pipalatine, lupeol, and 13,14-seco-stigmasta-5,3-diene-3α-ol was
isolated from the ethanolic extract of B. prionitis of Sri Lankan origin. All four of these expressed moderate inhibitory activity against the
enzymes glutathione S-transferase and acetylcholinesterase [15].
Anticataract activity
Anticataract activity of B. prionitis was estimated using selenite- and
galactose-induced cataract models in a study. The rats in the test
13,14-secco-stigmasta-5,14-diene-3α-ol have been isolated from the
ethanolic extract of B. prionitis, and these compounds showed a strong antibacterial activity against B. cereus and P. aeruginos [15].

### Table 1: Taxonomical classification of B. prionitis

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub Kingdom</td>
<td>Tracheobionta</td>
</tr>
<tr>
<td>Division</td>
<td>Magnoliophyta</td>
</tr>
<tr>
<td>Class</td>
<td>Magnolopsidia</td>
</tr>
<tr>
<td>Subclass</td>
<td>Asterida</td>
</tr>
<tr>
<td>Order</td>
<td>Scrophulariales</td>
</tr>
<tr>
<td>Family</td>
<td>Acanthaceae</td>
</tr>
<tr>
<td>Genus</td>
<td>Barleria</td>
</tr>
<tr>
<td>Species</td>
<td>Prionitis</td>
</tr>
</tbody>
</table>

**B. prionitis: Barleria prionitis**

### Table 2: Vernacular names

<table>
<thead>
<tr>
<th>Sanskrit</th>
<th>Marathi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vajradanti, Kurantaka, Koranta</td>
</tr>
<tr>
<td>Kannada</td>
<td>Gorante, gorantead, mulli jaali, mullu madarangi, muliogoranta</td>
</tr>
<tr>
<td>Malayalam</td>
<td>Manjakkanakambaram, Kanakambaram</td>
</tr>
<tr>
<td>Hindi</td>
<td>Manjakkanakambaram, Manjakkanambaram</td>
</tr>
<tr>
<td>English</td>
<td>Porcupine flower, Crossandra, Barleria</td>
</tr>
</tbody>
</table>

increased opacities as compared with normal. A full in the glutathione level and an increase in the malondialdehyde levels were seen in control rather than normal lenses. These results revealed that the onset and progression of cataract were hindered in selenite and so as in galactose-induced cataract. Slit-lamp microscopic images proved its antiecataract activity, which can be due to its antioxidant potential [32].

Anticancer activity
The oil prepared with the whole plant is applied externally during the acute stage of cysts in the blood vessels [33]. It shows its effective anticancer properties.

Anti-inflammatory activity
In a study, various extracts from the B. prionitis roots were extracted. These extracts were evaluated for their anti-inflammatory activity using carrageenan-induced rat paw edema at the dose levels of 200 and 400 mg/kg orally. The aqueous extract was found most active, it was then fractionated into four major fractions, and these fractions were also screened by the same tests. AQSE fractions (FR-IV) of B. prionitis showed maximum percentage inhibition of rat paw edema (52.56% and 55.76%) at a dose of 200 and 400 mg/kg, respectively. Anti-inflammatory activity was found to be dose dependent for all four fractions. These results provide a scenario for the use of this plant as an anti-inflammatory agent [34]. In another study, TAF fraction from the methanol-water extract of B. prionitis Linn. was evaluated for anti-inflammatory activity against different acute and chronic animal test models. Carrageenan, histamine, and dextran which are known inflammagens had anti-inflammatory effect produced by it. Adrenalectomized rats show normal anti-inflammatory activity that expresses that the effect of fraction “TAF” is not controlled by the pituitary-adrenal axis. "TAF" also showed inhibition of vascular permeability and leukocytes migration in vivo into the site of inflammatory insult. Ibuprofen was used as a standard reference drug [35]. In one study, methanolic extract of B. prionitis Linn. at the dose of 500 mg/kg showed anti-inflammatory activity in the early stage as well as in the late stage (up to 180 minutes) comparable to control and standard indomethacin [36].

Antinoceptive activity
One study was undertaken to evaluate the antinoceptive activity of 50% ethanolic extract of the flower of B. prionitis in experimental animals. The analgesic effect of the extract tested in mice of either sex, using an Ugo Basile Analgesy meter. A significant increase was measured in the algosensio-meter-induced force (p<0.01<0.001) at the dose level of 50, 100, and 200 mg/kg B. prionitis extract and exhibited resistance against pain after 30 minutes equivalent to 26.3-48.23% protection [37].

Antihypertensive activity
In a study, antihypertensive activity was evaluated in male albino Wistar rats, which were uninephrectomized. Hypertension was induced by injecting deoxycorticosterone acetate salt, rats were divided into five groups, different dose levels were administered twice a week for the duration of 6 weeks, and instead of water, 1% NaCl was provided for drinking to the rats. Dose levels of 200 mg/BW and 400 mg/BW showed the maximum antihypertensive effect among all. Significant antihypertensive activity is developed by the alkaloids, flavonoids, showed the maximum antihypertensive effect among all. Significant antihypertensive activity is developed by the alkaloids, flavonoids, saponins, tannin, and phenolic compounds, whose presence is known to affect blood pressure [37].

Cytotoxic activity
3-(4,5-dimethyl-2-yl)-2,5-diphenytriazolium bromide assay on human gingival fibroblast and human dermal fibroblast cell lines for ethanolic extract of B. prionitis gave cytotoxicity effects data. The concentration of test needed to inhibit cell growth by 50% (IC\textsubscript{50}) value was found to be more than 1,000 µg/ml. Chlorhexidine was found to be more cytotoxic with the IC\textsubscript{50} value of 1.25-2.5 µg/ml. Ethanolic extract of B. prionitis was found significantly cytotoxic (p<0.05) in comparison with control [39]. In another study, the methanolic extract of the whole plant of B. prionitis was studied for the anticancer activity of the Human Ovarian Cancer Cell Line Ovar-3 and human renal cancer cell line 786-O in different concentrations (10, 20, 40, and 80 µg/ml) along with standard drug Adriamycin (doxorubicin) (positive control compound). On the basis of the results, we can conclude that these extracts were non-cytotoxic [40].

Hepatoprotective activity
Iridoid-enriched fraction (IF) from the ethanol-water extract of the aerial parts (leaves and stems) of B. prionitis Linn. was evaluated for hepatoprotective activity in various acute and chronic animal test models of hepatotoxicity. It afforded significant hepatoprotection against carbon tetrachloride, galactosamine, and paracetamol-induced hepatotoxicity. Silymarin was used as reference hepatoprotective drug. In the safety evaluation study, the oral lethal dose (LD\textsubscript{50}) was found to be greater than 3000 mg/kg, with no signs of abnormalities or any mortality observed for a 15-day period under observation after a single dose of drug administered, whereas intraperitoneal LD\textsubscript{50} was found to be 25.3±287 mg/kg, SE(n=10) in mice. The studies discovered noteworthy and concentration-dependent hepatoprotective potential of “IF” because the maximum altered hepatic parameters which resulted in liver damage of the experimental rodents was reversed by it [41].

Central nervous system (CNS) activity
CNS activity of the 70% ethanol extract of leaves of B. prionitis Linn. (Acanthaceae) in Swiss albino mice was estimated. General behavior was studied using actophotometer. According to the study, it was observed that the test drug has the stimulant activity. However, in comparison with the standard drug, namely, fluoxetine hydrochloride available in the market, the stimulant activity seemed to be less. Fluoxetine stimulates activity in the animals was found to be 9.193%, whereas the test drug from B. prionitis stimulated the animal only by 49.72%. The results suggested that ethanol extract of B. prionitis exhibits antidepressant activity in testing animal models [42].

Anti-arthritis activity
The anti-arthritic potential of ethyl acetate fractions of chloroform extract from leaves of B. prionitis was evaluated by successive extraction with chloroform and methanol by the hot Soxhlet extraction method. The chloroform extract was further fractionated with solvent ethyl acetate to obtain EABP. Acute non-immunological and chronic immunological arthritis were induced in rats through formaldehyde and Freund’s complete adjuvant, respectively. Then, this fraction was evaluated at two doses 125 and 250 mg/kg, fed to the abovementioned group of rats. Significant inhibition of edema was observed in both acute as well as chronic models in dose-dependent manner. Dose level of 250 mg/kg showed most potent and significant paw edema inhibition. This finding thus supports the traditional use of B. prionitis for rheumatoid arthritis [43].

 Larvicidal activity
Larvicidal activity of various extracts of B. prionitis was estimated against the Japanese Encephalitis vector, Culex tritaeniorhynchus in Tamil Nadu, India. To identify the active principle present in the promising fraction obtained in Chloroform: Methanol extract. The B. prionitis leaf extracts were tested, employing the World Health Organization procedure against fourth instar larvae of C. tritaeniorhynchus, and the larval mortalities were recorded at various concentrations (6.25-250 µg/ml); the 24 hrs lethal concentration values of the B. prionitis leaf extracts were determined following Probit analysis. This investigation proved that B. prionitis could be possibly utilized as an important component in the Vector control program for the eradication of different harmful diseases [44].

Mast cell stabilization and membrane protection activity
Hydroalcoholic whole-plant extract of B. prionitis was tested for the membrane stabilization and mast cell protection activity, the results revealed significant inhibition of the hyposaline-induced erythrocyte membrane hemolysis. Mesenteric mast cells degranulation and
hemolysis of the erythrocytes was significantly reduced in the extract-treated rats \[45\].

The data on the pharmacological action of \textit{B. prionitis} are listed in Table 3.

**Table 3: Pharmacological action of \textit{Barleria prionitis}**

<table>
<thead>
<tr>
<th>Parts of plant</th>
<th>Type of extract/active principle</th>
<th>Animal model/microorganism/cell lines/tissues/assay</th>
<th>Uses</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf</td>
<td>Petroleum ether extract, ethanol extract</td>
<td></td>
<td></td>
<td>[14]</td>
</tr>
<tr>
<td>Leaf</td>
<td>Balarenone, pipataline, and 13,14-seco-stigmasta-5,14-diene-3-(\alpha)-ol isolated from ethanol extract</td>
<td></td>
<td></td>
<td>[15]</td>
</tr>
<tr>
<td>Leaf exudates and leaf tissue sap</td>
<td>Methanolic extract</td>
<td></td>
<td></td>
<td>[17]</td>
</tr>
<tr>
<td>Whole plant</td>
<td>Ethanolic extract</td>
<td>\textit{Pheretima posthuma}</td>
<td>Anthelmintic activity</td>
<td>[19,20]</td>
</tr>
<tr>
<td>Roots</td>
<td>Methanolic extract</td>
<td>Rats</td>
<td>Antifertility activity</td>
<td>[21]</td>
</tr>
<tr>
<td>Roots</td>
<td>BS isolated from methanolic extract</td>
<td>Rats</td>
<td></td>
<td>[25]</td>
</tr>
<tr>
<td>Leaf, stem</td>
<td>Methanolic extract</td>
<td>Reducing power assay</td>
<td>Antioxidant activity</td>
<td>[26]</td>
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<tr>
<td>Whole plant</td>
<td>Various fractions of 90%</td>
<td>DPPH assay</td>
<td></td>
<td>[27]</td>
</tr>
<tr>
<td>Aerial parts</td>
<td>Methanolic extract</td>
<td>DPPH free radical scavenging assay</td>
<td></td>
<td>[28]</td>
</tr>
<tr>
<td>Leaf, root</td>
<td>Alcoholic extract</td>
<td>Rats</td>
<td>Antidiabetic activity</td>
<td>[30]</td>
</tr>
<tr>
<td>Leaf, root</td>
<td>Alcoholic and aqueous extracts</td>
<td>Rats</td>
<td></td>
<td>[31]</td>
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<td>Aerial part</td>
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<td>Rats</td>
<td>Gluthathione S-transferase, acetylcholinesterase inhibitory activity</td>
<td>[15]</td>
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<tr>
<td>Whole plant</td>
<td>Oil</td>
<td>Cysts in acute stages of blood vessels</td>
<td>Anticancer activity</td>
<td>[32]</td>
</tr>
<tr>
<td>Roots</td>
<td>Various extracts</td>
<td>Rats</td>
<td>Anti-inflammatory activity</td>
<td>[33]</td>
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<td>Flower</td>
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<td>Mouse</td>
<td>Antinociceptive activity</td>
<td>[37]</td>
</tr>
<tr>
<td>Whole plant</td>
<td>Ethanolic extract</td>
<td>Male albino Wistar rats</td>
<td>Antihypertensive activity</td>
<td>[38]</td>
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<tr>
<td>Aerial parts</td>
<td>Ethanol-water extract</td>
<td>Rats</td>
<td>Cytotoxic activity</td>
<td>[39]</td>
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<tr>
<td>(leaves and stems)</td>
<td>Iridoid-enriched fraction IF from the ethanol-water extract</td>
<td>Rats</td>
<td></td>
<td>[40]</td>
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<tr>
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<td>70% ethanol extract</td>
<td>Swiss albino mice</td>
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<td>ethyl acetate fractions of chloroform extract</td>
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<tr>
<td>Leaves</td>
<td>Chloroform: Methanol, Acetone; Chloroform fractions of methanol extract</td>
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<td>Antiarthritic activity</td>
<td>[43]</td>
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<tr>
<td>Whole plant</td>
<td>Hydroalcoholic extract</td>
<td>Rat</td>
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<td>[44]</td>
</tr>
</tbody>
</table>

**PHYTOCONSTITUENTS IN \textit{B. PRIONITIS}**

Secondary metabolites play an essential role for the economic importance of medicinal plants, although it’s not only economical also a core prospective for the betterment of our health. Preliminary
phytochemical screening showed presence of phytochemicals such as alkaloid (by Mayer’s reagent test, Hager’s reagent test, Wagner’s reagent test, and Dragendorff’s reagent test), flavonoids (by alkaline reagent test and Shinoda test), saponins (Frothing test), terpenoids (dinitrophenylhydrazine test), phytosterol (Liebermann’s test and Liebermann–Burchard test), phenolic compound and tannin (FeCl₃, lead acetate test, and bromine water test), essential oil, proteins, and amino acids (Millon’s test, Biuret test, and ninhydrin test), carbohydrates (Molisch test, Fehling’s solution A, Fehling’s solution B, and Benedict’s test), glycosides (Borntrager’s test and legal’s test) [15,28]. Its aerial parts contain glycosides such as barlerinoside, shanzhiside methyl ester, lupulinoside, 7-methoxydideroside [45] barlerin, acetylbarlerin, and verbascoside [18]; terpenoid such as lupeol, pipataline, and balarenone; and flavones such as apigenin 7-O-β-D-glucoside [16] and luteolin-7-α-glucoside [45]. Leaves were reported to contain phenolic acids such as Melilotic acid [46], syringic acid, vanillic acid, and p-hydroxybenzoic acid and flavones such as 6-hydroxyflavone and scutellarin [47]. Roots contain phytosterol BS [25]. A brief summary of phytochemical constituents isolated from *B. prionitis* is given Table 4.

**CONCLUSION**

According to ethnomedical study, *B. prionitis* is very effective and safe for medicinal uses. The qualitative and quantitative analysis reported the presence of many bioactive constituents. Currently, some of the phytoconstituents have been isolated and identified from *B. prionitis*. These compounds and crude extracts have been screened for pharmacological activities by in vivo and in vitro models. The structural activity relation between isolated compounds and their target sites in the human body should be meticulously studied further. Analytical characterization of active principle, developing new strategies in clinical trials, and product development will facilitate *B. prionitis* to be considered as a potent herbal drug for the treatment of various chronic diseases in the near future.

**Table 4: Phytochemical constituents identified, isolated from *Barleria prionitis***

<table>
<thead>
<tr>
<th>Phytoconstituents</th>
<th>Isolated from</th>
<th>Structure</th>
<th>Molecular formula</th>
<th>Class</th>
<th>Possible activity</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barlerinoside</td>
<td>Aerial parts</td>
<td><img src="image" alt="Structure" /></td>
<td>C₄₂H₅₈O₂₃</td>
<td>Phenylethanoid glycoside</td>
<td>Glutathione S-transferase (GST) inhibitory activity</td>
<td>[45]</td>
</tr>
<tr>
<td>Lupulinoside</td>
<td>Aerial parts</td>
<td><img src="image" alt="Structure" /></td>
<td>C₂₅H₃₈O₁₆</td>
<td>Irido glucoside</td>
<td>Antioxidant activity</td>
<td>[45]</td>
</tr>
<tr>
<td>7-methoxydideroside</td>
<td>Aerial parts</td>
<td><img src="image" alt="Structure" /></td>
<td>C₂₀H₃₀O₁₃</td>
<td>Secoiridoids</td>
<td>Antioxidant activity, antiviral activity</td>
<td>[45]</td>
</tr>
<tr>
<td>Balarenone</td>
<td>Aerial part</td>
<td><img src="image" alt="Structure" /></td>
<td></td>
<td>Terpenoid</td>
<td>Glutathione S-transferase and acetylcholinesterase inhibitory activity, antibacterial activity</td>
<td>[15]</td>
</tr>
<tr>
<td>Lupeol</td>
<td>Aerial part</td>
<td><img src="image" alt="Structure" /></td>
<td>C₃₀H₅₀O</td>
<td>Triterpene</td>
<td>Anti-inflammatory and anti-cancer, glutathione s-transferase and acetylcholinesterase inhibitory activity, antibacterial activity</td>
<td>[15]</td>
</tr>
<tr>
<td>Melilotic acid</td>
<td>Leaves</td>
<td><img src="image" alt="Structure" /></td>
<td>C₉H₁₀O₃</td>
<td>Phenolic acid</td>
<td>Antioxidant activity, antiulcer activity</td>
<td>[46]</td>
</tr>
<tr>
<td>Vanillic acid</td>
<td>Leaves</td>
<td><img src="image" alt="Structure" /></td>
<td>C₈H₉O₄</td>
<td>Dihydroxybenzoic acid derivative</td>
<td>Anticancer activity, anti-inflammatory activity, antioxidant activity, antinociceptive activity</td>
<td>[47]</td>
</tr>
</tbody>
</table>

(Contd..)
<table>
<thead>
<tr>
<th>Phytoconstituents</th>
<th>Isolated from</th>
<th>Structure</th>
<th>Molecular formula</th>
<th>Class</th>
<th>Possible activity</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syringic acid</td>
<td>Leaves</td>
<td><img src="image1" alt="Structure" /></td>
<td>C&lt;sub&gt;9&lt;/sub&gt;H&lt;sub&gt;10&lt;/sub&gt;O&lt;sub&gt;5&lt;/sub&gt;</td>
<td>Phenolic acid</td>
<td>Antioxidant activity, anticancer activity, antimicrobial activity, antifungal activity, antidiabetic activity</td>
<td>[47]</td>
</tr>
<tr>
<td>6-hydroxyflavone</td>
<td>Leaves</td>
<td><img src="image2" alt="Structure" /></td>
<td>C&lt;sub&gt;15&lt;/sub&gt;H&lt;sub&gt;10&lt;/sub&gt;O&lt;sub&gt;3&lt;/sub&gt;</td>
<td>Flavone</td>
<td>Anti-inflammatory activity, antioxidant activity, anticancer activity</td>
<td>[47]</td>
</tr>
<tr>
<td>β-sitosterol</td>
<td>Roots</td>
<td><img src="image3" alt="Structure" /></td>
<td>C&lt;sub&gt;29&lt;/sub&gt;H&lt;sub&gt;50&lt;/sub&gt;O</td>
<td>Phytosterols</td>
<td>Anti-inflammatory activity, anticancer activity, anthelmintic activity, cytotoxic activity, antisteroidogenic activity, antifertility activity, antioxidant activity, antidiabetic activity</td>
<td>[25]</td>
</tr>
<tr>
<td>Scutellarin</td>
<td>Leaves</td>
<td><img src="image4" alt="Structure" /></td>
<td>C&lt;sub&gt;21&lt;/sub&gt;H&lt;sub&gt;18&lt;/sub&gt;O&lt;sub&gt;12&lt;/sub&gt;</td>
<td>Flavone</td>
<td>Antioxidant activity, anti-inflammatory activity, cardio protective activity, hepatoprotective activity, enzyme inhibitory activity</td>
<td>[47]</td>
</tr>
<tr>
<td>p-hydroxybenzoic acid</td>
<td>Leaves</td>
<td><img src="image5" alt="Structure" /></td>
<td>C&lt;sub&gt;7&lt;/sub&gt;H&lt;sub&gt;6&lt;/sub&gt;O&lt;sub&gt;3&lt;/sub&gt;</td>
<td>Phenolic derivative of benzoic acid</td>
<td>Antimicrobial activity, anthelmintic activity, anticancer activity, antiatherogenic activity, anti-inflammatory activity, antiallergenic activity, antioxidant activity, antithrombotic activity, cardioprotective activity</td>
<td>[47]</td>
</tr>
<tr>
<td>Apigenin 7-O-β-D-glucoside</td>
<td>Aerial parts</td>
<td><img src="image6" alt="Structure" /></td>
<td>C&lt;sub&gt;21&lt;/sub&gt;H&lt;sub&gt;20&lt;/sub&gt;O&lt;sub&gt;10&lt;/sub&gt;</td>
<td>Glycosyloxyflavone</td>
<td>Antibacterial activity, anti-inflammatory activity, antioxidative activity</td>
<td>[15]</td>
</tr>
<tr>
<td>Luteolin-7-o-glucoside</td>
<td>Aerial parts</td>
<td><img src="image7" alt="Structure" /></td>
<td>C&lt;sub&gt;21&lt;/sub&gt;H&lt;sub&gt;20&lt;/sub&gt;O&lt;sub&gt;11&lt;/sub&gt;</td>
<td>Flavone</td>
<td>Antibacterial activity, antioxidative activity, antimicrobial activity, hepatoprotective activity, anti-inflammatory activity</td>
<td>[45]</td>
</tr>
<tr>
<td>Verbascoside</td>
<td>Aerial parts</td>
<td><img src="image8" alt="Structure" /></td>
<td>C&lt;sub&gt;29&lt;/sub&gt;H&lt;sub&gt;36&lt;/sub&gt;O&lt;sub&gt;15&lt;/sub&gt;</td>
<td>Caffeoyl phenylethanoid glycoside</td>
<td>Antimicrobial activity, cytotoxicity activity, anti-inflammatory activity, antioxidant activity, antiviral activity</td>
<td>[18]</td>
</tr>
<tr>
<td>Pipataline</td>
<td>Aerial parts</td>
<td><img src="image9" alt="Structure" /></td>
<td>C&lt;sub&gt;19&lt;/sub&gt;H&lt;sub&gt;28&lt;/sub&gt;O&lt;sub&gt;2&lt;/sub&gt;</td>
<td>Terpenoid</td>
<td>Enzyme inhibitory activity, antioxidant activity</td>
<td>[15]</td>
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</table>
### Table 4: (Continued)

<table>
<thead>
<tr>
<th>Phytoconstituents</th>
<th>Isolated from</th>
<th>Structure</th>
<th>Molecular formula</th>
<th>Class</th>
<th>Possible activity</th>
<th>Reference</th>
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<tr>
<td>Barlerin</td>
<td>Aerial parts</td>
<td><img src="image" alt="Barlerin Structure" /></td>
<td>C_{14}H_{26}O_{12}</td>
<td>Iridoid glycosides</td>
<td>Antioxidant activity, antiviral activity, anticancer activity, enzyme inhibitory activity, anti-inflammatory activity</td>
<td>[18]</td>
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<tr>
<td>Acetylbarlerin</td>
<td>Aerial parts</td>
<td><img src="image" alt="Acetylbarlerin Structure" /></td>
<td>C_{14}H_{26}O_{12}</td>
<td>Iridoid glycosides</td>
<td>Antioxidant activity, antiviral activity, anticancer activity, enzyme inhibitory activity, anti-inflammatory activity</td>
<td>[18]</td>
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<tr>
<td>Shanzhiside methyl ester</td>
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<td><img src="image" alt="Shanzhiside methyl ester Structure" /></td>
<td>C_{17}H_{21}O_{11}</td>
<td>Iridoid glycosides</td>
<td>GST, AChE inhibitory activity, antioxidant activity</td>
<td>[45]</td>
</tr>
</tbody>
</table>

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### REFERENCES