

 <p>ISSN NO. 2320-5407</p>	<p>Journal Homepage: - www.journalijar.com</p> <p>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)</p> <p>Article DOI: 10.21474/IJAR01/13583 DOI URL: http://dx.doi.org/10.21474/IJAR01/13583</p>	
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RESEARCH ARTICLE

PAEDERIA FOETIDA: INDIGENOUS MEDICINAL PLANTS OF NORTHEAST INDIA

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Manuscript Info

Manuscript History

Received: 24 August 2021

Final Accepted: 27 September 2021

Published: October 2021

Key words:-

Paederia Foetida, Medicinal Plants, Indigenous, Phytochemicals, Therapeutic Properties, and Traditional Uses

Abstract

The plant *Paederia foetida* has customarily been utilized for restorative purposes, however, its system of helpful impacts has remained generally obscure. The northeastern locale of India comprises one of the biodiversity focal points of the world. The ethnic gatherings occupying this locale practice their particular customary information frameworks utilizing biodiversity for food and medical care. Among the less-concentrated plants, *Paederia foetida* has been utilized by different ethnic clans as food and medication. Many of its ethnobotanical properties relate to the hepatoprotective and gastrointestinal. This is a review of the ethnobotanical uses, phytochemistry, and therapeutic properties of *Paederia foetida* compiled from various reports. *Paederia foetida* is promising as a solution for the way of life- related conditions, particularly the treatment of liver cirrhosis. Its utility highlights the need for the evaluation of tribal plants as medicines and the species that could be considered for the development of new drugs.

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Introduction:-

The northeast region represents an important part of the Indo-Myanmar biodiversity hotspot and is one of the renowned 25th global biodiversity regions. This area contains more than one-third of India's total biodiversity. Out of 450 tribal communities in India, the northeast states alone are the dwelling place of 225 ethnic communities¹. These tribes have distinctive traditional knowledge systems based on the use of biodiversity for food, shelter, and health. Most of these plants are indigenous to this region and the knowledge base remains within the ethnic groups, there is a lack of awareness of these plants, accurate methods of preparation, edible and/or medicinal uses, and their active principles². There is a need for prioritization of research on wild plants with detailed studies on active principles and nutritional components. An estimated 1600 plant species are used in Indian traditional systems of medicine, of which more than 80% are used in ethnomedicine in northeast India alone, indicating the rich traditional knowledge systems of northeast India³.

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Figure:- *Paederia foetida* leaves.

Paederia foetida is one of 30 species in the genus *Paederia* in the family Rubiaceae is an extensive foetida smelling climbing plant⁴. It is mostly found in India, especially in the northeast state of Assam, Arunachal Pradesh, Tripura, Meghalaya, Manipur, Nagaland, and Sikkim, and in other countries such as China, Bangladesh, Japan, and Korea⁵. Different tribal communities from the North East to the South use the plant as a vegetable and treats various stomach disorders such as diarrhea and dysentery, as well as stomach swelling, to clean stomach, gastritis, in loose motion, indigestion, abdominal pain, etc... The leaf is additionally utilized as an enemy of ulcer specialist. Various scientific studies have been carried out to investigate the use of *Paederia* in the treatment of rheumatic affections, anti-inflammatory, hepatoprotective, tripsyChemolithotripsy, promote sexual vigor, increases the quantity of semen^{6, 7}.

Phytochemical and Antioxidant of *Paederia Foetida*

The presence of polyphenolic compounds such as flavonoids, tannins, and terpenoids was discovered in a phytochemical screening of *Paederia foetida* extract, and previous research revealed that the leaves are high in antioxidant compounds such as carotene and vitamin C⁸. The extract of *Paederia foetida* contains antioxidant compounds that can scavenge free radicals such as DPPH. By scavenging free radicals, phenolic compounds protect various organs of the body from damage and disease, while also maintaining normal human health. Tannins are found in many different plants⁹. Anticarcinogenic, antimutagenic, and antimicrobial properties have all been reported. Flavonoids and tannins may protect plants from pathogenic microorganisms due to their antimicrobial and antifungal properties^{10, 11}. Polyphenols and tannins have antimicrobial properties due to their ability to inhibit enzymes, disrupt membranes, and form metal ion complexes. Alkaloids have antimicrobial properties due to their ability to intercalate into parasite cell walls and DNA. *Paederia foetida* was able to infect both gram-positive and gram-negative bacteria¹². The antibacterial action of *Paederia foetida* might be ascribed to Polyphenols, flavonoids, tannins, and alkaloids¹³.

Traditional Uses in Food and Medicine in Northeast India

The plant is traditionally administered in a variety of forms by tribal peoples in the Northeast, depending on their needs/ailments¹⁴. For medicinal purposes, a decoction of the whole plant, leaf, stem, stem bark, or leaf juice is prepared. Tender leaves are boiled and served with Chile and salt as a meal¹⁵. Certain ethnic groups in India's Assam state cook the leaves with rice to treat rheumatism and gout, among other joint diseases. Tripura clan makes 'Gudak' with dry fish and *Paederia foetida* leaves¹⁶. The Nyishi tribes of Arunachal Pradesh use leaf juice to treat diarrhea, dysentery, and burns or scalding¹⁷. Certain tribal communities in other parts of India have also reported using the whole plant powder to treat weakness and rheumatoid joint pains. Its nutritional and medicinal value is enhanced by high levels of protein (5%), fat (1%), carbohydrate (3%), dietary fiber, minerals (potassium, magnesium, nitrogen, manganese, natrium, calcium, zinc, copper, phosphorus, and iron), vitamin C, and phenolic content^{18,19}. The traditional uses of *Paederia foetida* are listed in Table 1.

Table 1:- Traditional uses of *Paederia foetida* in Northeast India.

State	Local name	Plant part used	Traditional uses	References
Assam	Bhedailota in Assamese Kipi Bengdwng in Boro and Bungki-repuk in Mising tribe	Leaf	Abdominal pain, Allergy dysentery, and vegetable	20,21
Arunachal Pradesh	Upu tere in Nyishi, Yepe tere in Adi and Shedra wunyee in Aka tribe	Leaf, root	Kidney stone, loose motion, Urinary disorder, and digestive system	22,23
Meghalaya	Mei iwtung in Khasi and Pasim in Garo tribe	Leaf, root, stem	Diarrhea, anti-dote for snakebite and gout	24
Manipur	Stinkvine & Oinam	Leaf, fruit	Cough, womb problem, lung affections	25
Nagaland	Sii-zii or ajungzii in Ao- Naga tribe	Whole plant	Liver disorder, paralysis, piles, rheumatism dysentery, diabetes, and seminal weakness	26,27
Tripura	Gandha bhadali in Bengali and Dukupui in Kokborok	Twigs and leaf	Diuretic, as vegetable, diarrhea and liver disorder	28
Mizoram	Vawihuihhrui	Leaf, fruit	Rheumatism, liver disorder, toothache, skin disease	29
Sikkim	Berihara	Leaf, fruit	Diarrhea, diabetes, seminal weakness, liver disorder, and rheumatism	30,31

Pharmacological Activities and Mechanism of Action of *Paedria Foetida*

Hepatoprotective activity:

The hepatoprotective activity of a 70% ethanolic extract of *Paederia foetida* leaf in paracetamol-induced liver damage in a rat model. The anti-hepatotoxin potential of the plant extract was then tested in vitro against paracetamol-induced hepatic lesions. Extracts of *Paederia foetida* significantly increased serum glutamate-pyruvate aminotransferase (SGPT), total protein, and serum glutamate-oxaloacetate transaminase levels at doses of 50,200, and 400 mg/kg body weight of rat (SGOT). The plant extract significantly reduced hepatic lipid peroxide (LPO) levels in the paracetamol-induced rat by 40%. Other studies have discovered that it has a moderate hepatoprotective effect, implying that it could be used to treat a wide range of liver disorders³².

Anti-inflammatory activity:

The anti-inflammatory activity of the butanol fraction of a methanol extract of the defatted leaves of *Paederia foetida* produced a more potent inhibition of granulation tissue formulation in cotton-pellet implanted rats³³. It reduced liver aspartate transaminase activity but did not affect serum aspartate transaminase activity. The percentage of anti-inflammatory activity of *P. foetida* was shown to be dose-dependent. At two different dosages of 20.5 and 41 mg/kg⁻¹, the percentages of anti-inflammatory activity were 38.55 and 48.97 respectively, which was stronger than acetylsalicylic acid (37.5% of anti-inflammatory activity at a dosage of 50 mg/kg⁻¹) but weaker than hydrocortisone (61.46% of anti-inflammatory activity at a dosage of 0.5 mg/kg⁻¹)³⁴.

Antitussive activity:

In awake cats, an ethanolic extract of *Paederia foetida* was used to stimulate the laryngopharyngeal and tracheobronchial mucosal. With an oral dose of 200 mg/kg-1 b.wt. cough suppression. The anti-tussive activity of

Paederia foetida ethanolic extract was lower than that of a traditional narcotic anti-tussive medicine but comparable to that of a non-narcotic anti-tussive agent (dropropizine)³⁵.

Anti-ulcer activity:

There are numerous scientific and traditional claims about the benefits of *Paederia foetida* for gastrointestinal tract illnesses such as dysentery, stomach swelling, piles, abdominal discomfort, diarrhea, gastralgia, and other maladies such as gastritis or ulcer³⁶. In rats, anti-ulcer screening was performed using two methods: pyloric ligation and aspirin-induced ulcerations. As a result, the roots of *Paederia foetida* are said to have anti-ulcer properties, which may be attributed to the expected suppression of H₂ receptors, which inhibit gastric acid release induced by histamine and gastrin³⁷.

Anti-diarrheal activity:

The 70 percent ethanolic extract of *Paederia foetida* demonstrated anti-diarrheal activity in rats using castor oil and magnesium sulfate-induced diarrhea. The activity is caused by a decrease in gastrointestinal motility and a significant lengthening of the diarrhoeal latent period³⁸. In the castor oil study, the purging index (PI) value decreased after 1 hour at doses of 50, 200, and 400 mg/kg³⁹. Only at 500mg/kg did the effect last for 6 hours. The plant significantly reduced the purging index value in magnesium sulfate-induced diarrhea in a dose-dependent manner. In the castor oil study, the purging index (PI) value decreased after 1 hour at doses of 50, 200, and 400 mg/kg. Only at 500mg/kg did the effect last for 6 hours. The plant significantly reduced the purging index value in magnesium induced diarrhea in a dose-dependent manner⁴⁰.

Anthelmintic activity:

A methanolic extract of *Paederia foetida* leaves was tested for anthelmintic activity against *Pheretima Posthuma* and *Tubifex*. *Paederia foetida* completely eradicated *Bunostomum* sp. and *Monezia* sp. Over a week, at two-day intervals, at a dosage of 4-10 oz. based on body weight⁴¹.

Analgesic activity:

Analgesic activity was assessed in mice using the acetic acid-induced writhing inhibition method, and at a dose of 150 mg. kg p.o., considerable antinociceptive activity was detected. Hexane, ethyl acetate, and methanolic extract inhibited the enzyme by 21%, 9%, and 19%, respectively⁴². 50 mg/kg aminopyrine inhibited writhing by 63% in the same experiment. Analgesic action was thought to be caused by blocking the prostaglandin pathway⁴³.

Antibacterial activity:

The test includes two Gram-positive bacteria (*Staphylococcus aureus* and *Enterococcus faecalis*) and three Gram-negative bacteria (*Escherichia coli*, *Salmonella typhimurium*⁴⁴). The extract exhibited antibacterial activity against *S.flexneri*, *S.aureus*, *E.coli*, and *E.faecalis*. As per the early screening preliminary, *S.flexneri* was the weakest microorganisms. *S. typhimurium* was the safest. The experiment results clearly show that the *Paederia foetida* plant has antibacterial properties⁴⁵.

Anti-arthritis activity:

Arthritis is a chronic inflammatory disease that affects the joints as well as the tissues that surround them. *Paederia foetida* was found to be more effective in treating rheumatoid arthritis than *Merremia tridentate*, a South Indian medicinal plant used for the same condition. The plant can also reduce high levels of acute-phase proteins, making it disease-modifying drugs (NSAIDs), which do not affect these proteins⁴⁶.

Anticancer activity:

The plant can also lower high levels of acute-phase proteins, making it a disease-modifying anti-rheumatic drug (DMARD) with advantages over NSAIDs, which do not affect these proteins⁴⁷. The plant has anticancer properties, according to Bangladesh folk medicine. The traditional use of 50% ethanolic extract as an anticancer drug was justified after it was shown to have anticancer activity in tissue culture against human nasopharyngeal. This activity could be attributed to its anti-inflammatory or antioxidant properties^{48, 49}.

Anti-nociceptive activity:

Many pharmacological studies have shown that these two plants are effective pain relievers in folk medicine. At 300 mg/kg body weight, hexane and methanol extracts of *Paederia foetida* demonstrated significant anti-nociceptive efficacy in Swiss albino mice, with 37.4% & 25% decreases in the number of writhing elicited by acetic acid,

respectively⁵⁰. To test potential anti-nociceptive pathways, several receptors and ion channel blockers were used, including naloxone, glibenclamide, nimodipine, and L-NAME. PEF-induced antinociception was linked to glibenclamide-sensitive K⁺-ATP channels, whereas BF primarily inhibited antinociception via nimodipine-sensitive L-type Ca²⁺ channels^{51,52}. *Paederia foetida* is mostly made up of fatty acids (linoleic acid) and sterols (stigmasterol and -sitosterol), both of which have been linked to analgesic properties. The n-butanol fraction contains a high concentration of iridoid glycosides, which prompted us to investigate the analgesic properties of these chemicals^{53,54}.

Effect on digestive system:

Several studies have shown that *Paederia foetida* is effective in the treatment of digestive disorders. In India, a decoction of *Paederia foetida* leaves and shoots (30 ml, 10 g in 100 ml water) is used to treat abdominal colic and gastric ulcers, while worms are treated with a decoction of fresh crushed root (10 g in 100 ml water)⁵⁵. In Mauritius, *Paederia foetida*, an alien plant, is used to cure ulcers and other ailments⁵⁶. In Assam⁵⁷, the aerial portions of *Paederia foetida* were used to treat diarrhea and dysentery, and a decoction of the leaves was used orally to relieve stomachaches. Anti-ulcer and anti-inflammatory properties were also found in the leaf extract⁵⁸. *Paederia foetida* (500 mg/kg) had a significant antidiarrheal ability in mice in the castor oil and magnesium sulfate-induced diarrhea models, which justified its traditional use in the treatment of diarrhea⁵⁹. Furthermore, the juice of *Paederia foetida* leaves (8%) had a prophylactic effect in rats against ethanol-induced stomach ulcers^{60, 61}. The root extract of *Paederia foetida* was recently shown to have strong anti-ulcer efficacy in lowering gastric acid output and thus preventing ulceration in rats caused by pyloric ligation and aspirin, which justified its traditional use in folk medicine⁶².

Antioxidant activity:

The antioxidant activity of fresh and dried *Paederia foetida* plant extracts was investigated using -carotene bleaching and the 2, 2'-azino bis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) radical cation test⁶³. Using both assays, the percentage of antioxidant activity of fresh samples ranged between 58 and 80 percent, while the percentage of antioxidant activity of dried samples ranged between 68 and 6 percent. The presence of vitamin C as one of the metabolites may contribute to its antioxidant properties. Another study using the DPPH assay discovered free radical scavenging activity with an IC₅₀ value of 4.53 mg/ml⁶⁴.

Conclusions:-

Paederia foetida is widely used as a medicinal plant, but studies show that it can also be eaten. It is one of the most popular vegetables among tribal communities in Northeast India. The plant extract has several medicinal properties, the most common of which are hepatoprotective. Other therapeutic benefits include gastrointestinal diseases, anti-inflammatory properties, arthritic properties, analgesics, and antioxidants, among others. *Paederia foetida* extract could be studied further in the future as a source of beneficial phytochemicals for the pharmaceutical industry.

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