

Review Article

Ethno-Medicinal Uses of Piper betel— A Review

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ABSTRACT

Herbal medicines are widely used as alternative treatments for various chronic diseases. They have proved to be of immense importance in treating many diseases and conditions. These medicines have potential to decrease the side effects of other drugs. In this regard Betel vine (Piper betel) leaves are known for its medicinal properties since long. It is a cash crop for many under developed Southeast Asian countries and therefore also known as "Green Gold and Green Heart" in those countries, as many people cultivate this crop to meet their both ends. The contemporary world approves its several medicinal properties as the growth of knowledge in this regard is unprecedented. The objective here is to reveal the potential effect of this plant against different diseases. Along with its tradomedical uses which signify its tremendous potential, it is also used towards cure of many antimicrobial ailments of great concern. The leaf extract and purified compounds are found to play a vital role and are of immense benefits in oral hygiene, anti-diabetic, cardiovascular, anti-inflammatory, and anti-ulcer. The active compounds isolated from leaf and other parts have great therapeutic role. This paper basically focus on emphasizing the varied pharmacological properties of Piper betel Linn along with its traditional uses and a cursory view of its active constituents.

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GRAPHICAL ABSTRACT


1. Introduction

Piper betel Linn, in local term refers to Paan, from the family Piperaceae (**Fig. 1.**) is commonly known as the betel vine. It is an important herb and has known medicinal and recreational properties. It also has many traditional benefits too. It is cultivated in Southeast Asia. Though, the place of origin of betel is Malaysia. Yet, fortunately, today it has been cultivated in Srilanka, India, Bangladesh and other parts of the world too [1]. It is claimed by many anthropologists that back in 5500-7000BC, the traces of betel have been found by them in the caves in Northwest Thailand. This claim is, however, proven by having seen some hardened chewers in Thailand. They have been found with black teeth's as a result of long years of chewing betel [2].

Interestingly, the plant has given different names in different languages. In colloquial terms the plant is known as Betel vine in English), in Urdu/Hindi it is called as Paan, Tanbol in Arabic, Bulung samat (Kapampangan), Vettila, Vettilakkoti (Malayalam), Plu (Mon), Malus

(Tetum), Maluu (Khmer), Plue (Thai), Malu (Tokodede), Vetrilai (Tamil), Tanbol, Burg-e-Tanbol in Persian, Daun sirih (Malay), Papulu (Chamorro) and Trâu (Vietnamese) [3]. The names of beetle vine in various Southeast Asian languages can be found enlisted in **Table 1** [1]. Piper betle's leaf extract has a great potential for treating toxoplasmosis [4]. The leaf extract is used as an antiseptic in wounds and cuts, is used mainly as a diuretic, aids in digestion, and treats boils, conjunctivitis, stomach problems, hysteria, leucorrhea, itches and ringworm [5]. Piper betel is a plant with known ethno medicinal properties. Its use was known for centuries to many people for its unprecedented medicinal properties. It is used to reduce bad body odor and bad breath, also in treating throat and lung problems and cough prevention. Moreover, it has also been used to reduce unwanted vaginal secretions and bad odor along with prevention of itching caused by fungus [6].

No doubt, this plants' cultivation entails very important place in agriculture. For its cultivation,

fertile soil is of best choice and saline or alkali soils do not yield desired results. Rather, these soils are extremely unsuitable and dangerous for its cultivation. A sort of garden namely "barouj" is prepared in Bangladesh in which betel vine is grown.

The barouj garden is fenced with bamboo sticks and coconut leaves, and on top it is covered by paddy leaves. Betel vine is best grown in moderate moist soil. Excessive moisture is harmful for its growth and cultivation. Owing to this, light irrigations should be given in a frequent manner. In order to reduce any threat to the plan, the quantity of irrigation water should be maintained in a manner that the standing water should not remain for more than half an hour in the bed. For this purpose, proper drainage should be done immediately. Morning or evening is the best time for irrigation [7]. Betel vine has been given an esteemed place in countries like India, Pakistan, Bangladesh, China, Sri Lanka, Burma, Philippines, Nepal, Indonesia and Malaysia. In these countries particularly, its raw leaves are chewed along with certain other things, such as: coconut, sliced areca nut, aniseed, coriander, cardamom etc. There are many varieties of betel leaf based on its taste, color, aroma and size. Some of these varieties include Mysore, Kauri, Magadhi, Banarasi and Venmony [8].



Fig. 1. Piper betel Linn

Table 1. Other names of Piper betel in various languages

Languages	Names
Sanskrit	Nagini Hindi, Bengal, Urdu Paan
Arabic	Tanbol
Persian	Burg-e-Tanbol
Tamil	Vettilai
Khmer	Maluu
Urdu/Hindi	Pan
Vietnamese	Trầu
Mon	Plu
Telugu	Tamalapaku
Kapampangan	Bulung samat
Sinhalese	Bulath
Chamorro	Papulu
Konkani	Phodi paan
Kannada	Vilya, Veeleya, Villayadel

2. Plant profile

The scientific classification and botanical name of Piper betel Linn (Golden Heart), are as follows [1-2].

Table 2. The scientific classification and botanical name of Piper betel Linn

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnolipsida
Family	Piperaceae
Genus	Piper
Specie	betel
Scientific name	Piper betel Linn. (betel vine)

3. Ethno Botanical uses of different parts of Piper betel (Betel vine) and its bio-active components

➤ **Leaf:** The leaf extract is used as antifungal, anti-malarial and antioxidant. It is also used in the treatment of cough and indigestion particularly in children. It also has anti-malarial, antibacterial, insecticidal, anti-

diabetic, gastro protective and cytotoxic activities.

- *Stem*: It is proved to be efficient for the treatment of cough, asthma, indigestion, and bronchitis.
- *Whole plant*: Piper betel is used as a food and in spices. It has also notable uses in perfumes, oils, hallucinogens and anti-infectious agents because of its pungent taste. Recent research has proved its anti-wormal uses too. Some other uses include its normalization of digestive tract and maintenance of digestive system. It does this because of its light properties [8].
- *Bio-active components*: Piper betel has many important constituents. Major constituents of Piper betel are chavibetol (53.1%) and chavibetol acetate (15.5%). Other constituents are α -pinene (0.21%), β -pinene (0.21%), α -limonene, safrole and 1, 8-cineole, allypyrocatechol diacetate, campene, chavibetol methyl ester, eugenol. Hexane fraction of leaf stalks was found to have four aliphatic compounds pentadecyl 6-hydroxytridecanoate, pentatriacontanol, methyl betel was found to possess strong antioxidant effects and they include: polyphenols like eugenol, chavicol, charvacrol, chevibetol, catechol and allyl pyrocatechol and vitamin C [8]. The leaf of betel contains Water (85-90%), Proteins, Carbohydrates, Minerals, Fat, Fibre (2.3%), Essential oil (0.08%), Tannin, Alkaloid (arakene), Vitamin-C, vitamin B3, Vitamin-A, vitamin B1, vitamin B2, Calcium, Iron, Iodine, Potassium. Its leaves have bitter compounds upto 0.7-2.6%. It has a specific pungent aromatic flavor in leaves because of phenol and terpene like compounds. Some of the structures of the constituents of the plant are given in the scheme 1 [2].

4. Morphological features of leaf of Piper betel

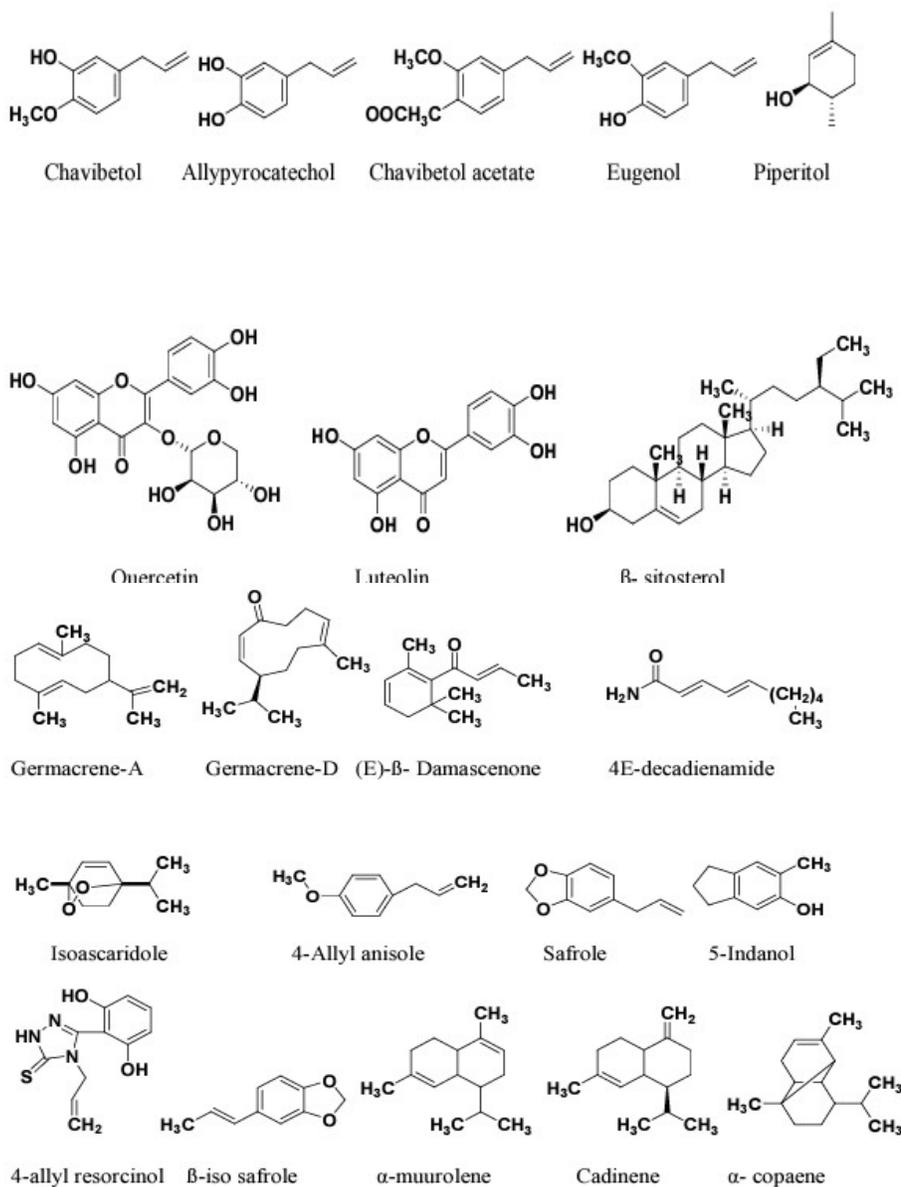
The leaves have aromatic and pungent flavor with characteristic pleasant odor. The fresh leaves have green to dark green color (**Fig. 2**). These morphological features such as the presence of foreign organic matter, odor, size, color, and shape are described in **Table 2** [9].

5. Traditional uses of Piper betel

1. The paste of Piper betel leaves along with salt and hot water (not very hot) can be used for treating filariasis.
2. It also helps in curing obesity when one Piper betel leaf is mixed with Piper nigrum and used for two months.
3. For treatment of coughs, dyspnea (shortness of breath), and indigestion, especially amongst children, juice of betel is used with honey for better results.
4. Leaves of Piper betel are supposed to promote milk secretion in lactating women. When these leaves are smeared with oil and used on breasts they have better effects in lactating women.
5. Its local application is also good for orchitis, arthritis and mastitis.
6. Its leaves are occasionally utilized for treating cough and dyspnea in children and old people. Laves are mixed with mustard oil and then used on chest.
7. Used to reduce bad breath, bad body odor and prevent tooth decay in people of any age.
8. Prevents and reduce itching and infections of the vagina.
9. Stop nose bleeding.
10. It contains vitamins such as thiamine (B1), niacin (B3), riboflavin (B2), and carotene.
11. Leaves are used for curing eczema, and rheumatism.
12. Paste of leaves is applied on cuts and wounds to have better effects.
13. Roots of Piper betel along with black pepper are used to generate sterility in women.
14. Oil is used for irritation in throat, and larynx.

Table 2. Morphological features of leaf of Piper betel

Sr. No.	Characters	Piper betel Linn
1.	Dimensions	Length of leaf: 8-16cm Width: 6-12cm
2.	Taste	Aromatic
3.	Odor	Characteristic and pleasant
4.	Color and condition	Green to dark green and fresh leaves



Scheme 1. Some of the structures of the constituents of the plant



Fig. 2. Morphology of leaf of Piper betel Linn

15. Juice of leaves is used as febrifuge i.e. an agent used for fever treatment [10].

16. The leaves of this plant have proved to be extremely useful remedy for piles. First, the leaves are warmed. When they get soft, they are coated with castor oil layer. Now this oily leaf when applied to the inflammatory area, it yields better results.

17. Its leaves have great cooling and analgesic properties.

18. Leaves have exceptional nutritive properties. Its six leaves, with some slaked lime, are substitute for 300 mL of cow milk because of its mineral and vitamin nutrition [8].

6. Modern medicinal uses

6.1. Antibacterial activity

Piper betel Linn leaf extract helps increase salivation in oral cavity. It thus increases peroxidases, antibodies and lysozyme in saliva which act against bacterial growth in mouth [11]. Its leaf extracts have certain important phenolic constituents and essential oils which have antibacterial properties against many bacteria in oral cavity. Moreover, it has proven effects against bacteria vibrio cholera ogawa. Further, its leaf extract also kills and inhibits outrageous bacteria which cause typhoid and tuberculosis etc., [6, 10]. Research based study indicates that Piper betel is effective against following bacterial strains: *Listeria monocytogenes*, *Staphylococcus*

aureus, *Bacillus cereus*, *Pseudomonas aeruginosa*, *Salmonella enteritidis*, *Streptococcus pyogenes*, *Streptococcus mutans*, *Enterococcus faecalis*, *Fusobacterium nucleatum*, and *Prevotella intermedia* [12].

6.2. Prevention of halitosis

Halitosis is defined as oral malodor or bad breath. It is caused by gingival cervical fluid, microbial degradation of proteins, amino acids, and peptides in saliva, and sometimes food retained on teeth because of no proper brushing. The leaves of Piper betel have been used traditionally for halitosis since long time. It has been proven by research based study that it helps in prevention of bad breath and acts as breath freshener. For this purpose, its leaves are chewed either solely or along with other spices such as: clove, cardamom, cinnamon and areca nut [13].

6.3. As an anticancer agent

Contrary to general belief that betel leaves cause cancer of oral cavity, studies has amply proven the fact that Piper betel leaves have no such cancerous effects; rather, they possess anticarcinogenic and antimutagenic effects. It prevents oral carcinogenesis. As per standard data, globally, oral cancer has been ranked amongst one of the ten common cancers. Its leaves have important phytochemicals which possess anticancer effects. Its leaf extracts help reduce tumor burden and is utilized to increase latency period of tumor. By combining its extracts with turmeric, it yielded positive results against cancer.

It also helps prevent skin cancer. 75% of skin carcinoma is originated by basal cells and 15% accounts for squamous cells carcinoma. Studies show that by topical application of betel leaf extracts β -carotene and α -tocopherol, tumor formation can be reduced effectively. Moreover, betel leaf has also preventive effects in mammary cancers. Breast cancer is the second most common cancer in the world. It is the leading

cause of cancer related death in women. Its leaf extracts administration through mouth decreased tumor incidence and also tumor burden [1].

6.4. Antidiabetic activity

Studies show that Piper betel leaves ethanolic and aqueous extracts have marked antidiabetic activity. When its leaf extracts were used in streptozotocin-induced diabetic rats, it yielded better results by significantly lowering the blood glucose levels. This hypoglycemic effect of betel leaves extracts was dose dependent and remained till four hours [14]. Its extracts have also showed marked antihyperglycemic activity in glucose tolerance test [8].

6.5. Gastro protective activity

Piper betel Linn has been used for curing gastric ulcers since long time. It also has gastro protective activity. Its leaves have hot aqueous extracts (HAE) and cold ethanolic extracts (CEE), which if administered orally, can provide considerable protection against gastric damage caused by ethanol. Both the extracts in highest doses show greater effects against gastric damage. HAE also inhibit increase in gastric acid volume. It is also thought to increase mucus content of gastric mucosa. Thus, HAE and CEE show great gastro protective activity [14].

6.6. Antiallergic activity

Piper betel ethanolic extracts show considerable antiallergic activity. Researched based study shows that it affects the production of granulocyte macrophage-colony-stimulating factor (GM-CSF) and histamine. These are produced by murine bone marrow mast cells (BMMCs). Betel extracts have considerably decreased the production of GM-CSF and histamine by an IgE-mediated hypersensitive reaction. Therefore, it can be substantiated that betel offers great control of allergic diseases. It stops the production of allergic mediators [15].

6.7. Antihypercholesterolemic effects

Piper betel has exceptional antihypercholesterolemic effects.

Hypercholesterolemia or hyperlipidemia can be defined as increase cholesterol or lipid level in blood. It is a major risk factor in causing cardiovascular (CVS) disorders. It causes atherosclerosis; which ultimately leads to scores of CVS disorders. When hypercholesterolemic rats who possessed higher blood level of glucose, triglycerides, low density lipoproteins (LDL), and total cholesterol; were treated with betel extract up to 500 mg/kg b.wt orally for up to seven days, results were affirmative as cholesterol and other related parameters got better than before. Thus, the results showed Piper betel extract's anticholesterolemic effects [16].

6.8. Wound healing activity

Different research data reveal wound healing activities of Piper betel Linn. Its leaf extract, when applied on wound, showed considerable healing effects on wounds [7, 17].

6.9. Anti-inflammatory activity

Piper betel has significant anti-inflammatory activities too. Inflammation is the response of supporting and vascular elements of tissue to any sort of injury. This, in result, forms a protein rich exudate if the injury is not severe enough and there is no tissue destruction. Its leaves have ethanol extracts which possess anti-inflammatory activity. It yielded positive results in this regard when examined in a rat suffering from chronic inflammation. However, there are not enough studies conducted in this regard [18].

6.10. Cholinomimetic effect

The leaf of Piper betel contains calcium channel antagonist and certain cholinomimetic constituents which provide considerable cholinomimetic effects rendered by this plant. It

has also been proved that it causes increase in body temperature due to its cholinergic effects [8].

Nevertheless, nowadays several medicinal plants have been extensively used in the field of nanotechnology [19-35].

Conclusion

Piper betel is, undoubtedly, a great source of various nutrients and phytochemicals. This study shows its unprecedented benefits and properties in curing various diseases. As aforementioned, it has anticancer, anti-microbial, anti-inflammatory, cholinomimetic and antifungal activities. It also cures bad breath, conjunctivitis, constipation, itches, and headache. For the treatment of swelling of gum, abrasion, cuts, and rheumatism, it has been in use since time immemorial. These therapeutic effects are possible due to the presence of saponin, caravacol, anethole, hydroxychavicol acetate, isoeugenol, and steroids etc. According to the study, the leaves of betel have anti carcinogenic effects. This is contrary to the belief that it is the cause of oral cancer. It is not the cause of oral cancer as is proven by this study.

Thus it can be concluded that the leaves of the Piper betel or more properly Golden Heart, possess a great potential as a novel source for different therapeutic uses. As aforementioned, the plant is fit for future uses as a great source for treating various diseases. It is, therefore, need of the time to evaluate its potential benefits to get full benefits out of it. This review, thus suggests, that the leaves of P. betel contains a number of important phytoconstituents to be used for therapeutic purposes.

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