

A Review: Nutraceuticals Properties of *Piper betel* (Paan)

Ekta Singh Chauhan, Jaya Aishwarya*, Akriti Singh and Anamika Tiwari

Department of Food Science and Nutrition, Banasthali University, Banasthali, Distt.- Tonk. Rajasthan, 304022, India

Address for Correspondence

Department of Food Science and Nutrition, Banasthali University, Banasthali, Distt.- Tonk. Rajasthan, 304022, India

E-mail:
aishwarya.jaya16@gmail.com

ABSTRACT

Piper betel or Betel vine deep green heart shaped vary famous leaves belongs to the family Piperaceae called Paan leaves in India; rich in nutrients, minerals, vitamins, antioxidants, phytochemicals. *Piper betel* is mostly use to chew with sliced areca nut, slaked lime, coriander, aniseed, clove, cardamom, sweetener, coconut scrapings etc, but less used remedy. It is cultivated in hotter and damper part in country following the traditional methods in India on about 55,000 hectare with an annual production worth about Rs 9000 million. Focusing on traditional use and medicinal use of *Piper betel* we can cure many diseases and reduce the oral cancer which actually happens due to sliced areca nut, slaked lime not because of betel leaves. Leaves are rich in many nutrients like water, energy, protein, fats, fiber, calcium and iron etc. and the antioxidants present are flavonoids, tannins, saponins alkaloids, terpenoids etc. *Piper betel* helps in curing various diseases like diabetes, hypertension, brain toxin, halitosis, boils and abscesses, obesity, wound healing, voice problems, conjunctivitis, constipation, headache, hysteria, itches, mastitis, mastoiditis, leucorrhoea, otorrhoea, ringworm, swelling of gum, rheumatism, abrasion, cuts and injuries etc. So, we have to highlight these nutrients rich betel leaves and its benefits. This paper put a light on nutraceuticals properties of betel leaves and says that cultivation and use of betel leaves should be increased to cure the diseases.

Keywords: *Piper betel*, Nutrients, Phytochemical, Antioxidants, Aeca nut, Cultivation.

INTRODUCTION

Piper betel or Betel vine deep green heart shaped vary famous leaves belongs to the family of Piperaceae and has over 2000 species and indigenous to India. A well-

prepared betel quid is still regarded as an excellent mouth freshener and mild vitalize, routinely served on the social, cultural and religious occasions like marriage, religious

festivals, sraddha ceremony (religious function performed after cremation) etc. The most likely place of origin of *Piper betel* vine is Malaysia but it is also cultivated in India, Srilanka, Bangladesh, Burma and Nepal. *Piper betel* leaves are popularly known as Paan leaves in India, which are consumed by about 15-20 million people in the country. It is cultivated following the traditional methods in India on about 55,000 hectare with an annual production worth about Rs 9000 million. On an average about 66% of such production is contributed by the state of West Bengal where it is cultivated on about 20,000 hectare encircling about 4-5 lakh *Boroj* employing about the same number of agricultural families^{1,2}. *Piper betel* leaves are well-off in moisture, protein, fats, minerals, vitamins and in phytochemical and also antioxidants. It helps in curing and treatment of various diseases like halitosis, boils and abscesses, conjunctivitis, constipation, headache, hysteria, itches, mastitis, mastoiditis, leucorrhoea, otorrhoea, ringworm, swelling of gum, rheumatism, abrasion, cuts and injuries etc³.

The vine is a dioeciously (male and female plants are different) shade loving perennial root climber. There are about 100 varieties of betel vine in the world, of which about 40 are found in India and 30 in West Bengal. The most possible place of origin of betel vine is Malaysia. In spite of its likeness, the plant is much more popular in India than in any other country of the world since the distant past⁴. In these citations, significance of the leaves has been explained in relation to every sphere of human life including social, cultural, religious and even day-to-day life, which is very much relevant even these days⁵. This edible leaf has achieved an esteemed position in the human society right from the dawn of civilization. Particularly in the countries like Bangladesh, Burma, China, India, Indonesia, Malaysia,

Nepal, Pakistan, Philippines, South Africa, Sri Lanka, Thailand. Leaves are traditionally used for chewing in their natural raw condition along with sliced areca nut, slaked lime, coriander, aniseed, clove, cardamom, sweetener, coconut scrapings, ashes of diamond, pearl, gold and silver, jelly, pepper mint, flavoring agent, fruit pulp. Based on the color, size, taste and aroma there are many varieties of betel leaf and some of the most popular Indian varieties are the Magadhi, Venmony, Mysore, Salem, Calcutta, Banarasi, Kauri, Ghanagete and Bagerhati^{4,6}.

Piper betel vine is a tropical shade-loving perennial evergreen vine. It may climb as high as 10-15 ft. The *Piper betel* leaf prefers a warm and humid climate. Leaves are simple, alternate, ovate, cordate, acuminate or acute, entire and bright green. This plant has Male spikes which are dense and cylindrical while female spikes are pendulums. Roots arise from each node which aid in fixing the plant to the host tree. The color of pepper betel is yellowish green to dark green with glossy upper surface where as the odor is characteristic and pleasant. The betel leaves are aromatic with varied taste, ranging from sweet to pungent due to the presence of essential oils^{6,7}.

Chemical Composition

Piper betel leaf has been described to have piperol-A, piperol-B, methyl piper betlol and they also have been isolated⁸. *Piper betel* leaves have an essential oil composing of terpinen-4-ol, saffrole, allyl pyrocatechol monoacetate, eugenol, eugenyl acetate, hydroxyl chavicol, eugenol, piper betol and the betel oil contains cadinene carvacrol, allyl catechol, chavicol, p-cymene, caryophyllene, chavibetol, cineole and estragol as the major components^{9,10}.

Nutritional Composition

The proximate analysis of the leaves of *Piper betel* showed that it contained macro and micro nutrients as well as phytochemical shown in table-3.

Phytochemicals

Piper betel contains a wide variety of biologically active compounds whose concentration depends on the variety of the plant, season and climate. Chemical compositions of essential oil constitute safrole present in the leaf, stalk, stem, root and β -phellandrene present in the fruit. The presence of hydroxychavicol acetate, allylpyrocatechol piperbetol, isoeugenol, anethole, stearic acid, methyl eugenol, carvacrol, polyphenol, alkaloids, saponin, tannin, steroids and other compounds are also found in *Piper betel*⁵. The aroma of betel leaf is due to the presence of essential oils, consisting of phenols and terpenes¹². The active ingredient of piper betel oil which is obtained from the leaves is primary a class of allyl benzene compounds, chavibetol, chavicol, estragole, eugenol, methyl eugenol and hydroxycatechol^{8,13}.

Bio- Active Components

Major constituents of *Piper betel* are chavibetol (53.1%) and chavibetol acetate (15.5%). Other constituents were allylpyrocatechol diacetate (0.71%), campene (0.48%), chavibetol methyl ester (0.48%), eugenol (0.32%), α -pinene (0.21%), β -pinene (0.21%), α -limonene (0.14%), safrole (0.11%) and 1, 8-cineole (0.04%). Hexane fraction of leaf stalks yielded four aliphatic compounds in pure form pentadecyl 6-hydroxytridecanoate, pentatriacontanol, methyl hexacos-7-enoate and 6, 9-heptacosa diene^{14,15}. The principle chemical constituents of *Piper betel* were found to be polyphenols like eugenol, chavicol, charvacrol, chevibetol, catechol and allyl pyrocatechol and vitamin C, which

were reported to exhibit strong antioxidant activity. Further these polyphenols exert their protective activities through their superior radical scavenging and immune modulating potentials¹⁶.

Therapeutic Importance

Piper betel possess various pharmacological properties include anticancer, antimutagenic, anti-amoebic, anti-giardial, anti-inflammatory, mosquito larvicidal, antimicrobial, immunomodulatory, antiulcerogenic, radio-protective, antileishmanial, and antifungal activity¹⁷. In addition the leaf extract has also been reported to have antioxidant, antimicrobial, antifungal, anti-inflammatory and radio-protective properties^{18,19}. *Piper betel* leaf is also useful for the treatment of various diseases like bad breath, boils and abscesses, conjunctivitis, constipation, headache, hysteria, itches, mastitis, mastoiditis, leucorrhoea, otorrhoea, ringworm, swelling of gum, rheumatism, abrasion, cuts and injuries as folk medicine while the root is known for its female contraceptive effects²⁰.

Ethno Botanical Uses of *Piper betel*²¹

Leaf

The leaf juice is given systemically to treat cough and indigestion in children and also as anti-malarial activity, antibacterial activity, antifungal study, insecticidal activities, antioxidant activity, anti-diabetic activity, gastro protective activity, antinociceptive activity, cytotoxic activity and anti-platelet.

Stem

Stems are supposed to be useful in treating indigestion, bronchitis, constipation, coughs and asthma.

Whole plant

The plants of genus *Piper* are also used for many other purposes such as foods and spices, fish bait, fish poison, hallucinogens, insecticides, oils, ornaments, perfumes, antiwormal and anti-infectious agent because of its pungent taste. It helps in normalizing the digestive tract hence is very effective in maintaining the digestive system because of its light properties.

Pharmacological Profile^{3,6,22}

Antimicrobial activity

The betel shows the antimicrobial activity against *Streptococcus pyrogenes*, *Staphylococcus aureus*, *Proteus vulgaris*, *Escherichia coli* and *Pseudomonas aeruginosa*. Beside of this the leaf extract also possess the bactericidal activity against the urinary tract pathogenic bacteria such as *Enterococcus faecalis*, *Citrobacter koseri*, *Citrobacter freundii* and *Klebsiella pneumonia*^{23,24}. Dermatophytosis is a disease of the keratinized parts of the body (skin, hair, and nail) caused by athree genera of highly specialized fungi called the Dermatophytes²⁵ is also cured by it. Protective and healing activity most recently, a study was undertaken to evaluate the protective and healing effects of allylpyrocatechol against the indomethacin induced stomach ulceration in rat model^{26,27}.

Antidiabetic activity

The aqueous and ethanolic extracts of *Piper betel* leaves possess marked hypoglycaemic activity when tested in fasted normoglycaemic rats. In glucose tolerance test, the extract showed antihyperglycaemic activity in the external glucose level²⁸.

Gastroprotective activity

Mucus layer is considered to be important in mucosal defenses against endogenous aggressors, acids and also as an

agent in facilitate the repair process. The higher dose of hot water extract does not cause significant inhibition in acidity or pH of gastric fluid²⁹. The extensive research has been proven that anti-oxidants might be effective mechanism not only in protecting against gastric mucosal injury, but also inhibiting progression of gastric ulceration. Ulceration progression is caused by free radical-induced chain process. Consequently, its arrest by radical scavengers helps in the faster healing. Allylpyrocatacol has shown a powerful anti-oxidant potential in various in-vitro models³⁰.

Immunomodulatory activity

The decrease in antibody titer and increased suppression of inflammation suggests possible immunosuppressive effect of extract on cellular and humoral response in mice³¹.

Platelet inhibition activity

Hydroxychavicol (HC) was tested for its inhibition effect on platelet aggregation. The result showed hydroxychavicol to be a potent inhibitor for cyclooxygenase activity, reactive oxygen scavenger and inhibits platelet calcium signaling, thromboxan B2 production and aggregation. HC could be a potential therapeutic agent for prevention and treatment of artherosclerosis and other cardiovascular diseases through its anti-inflammatory and antipatelets effects, without effects on homeostatic function³².

Oral care agent

Dental caries is a chronic endogenous infection caused by the normal oral commensally flora. The carious lesion is the result of demineralization of enamel and later of dentine by acids produced by plaque microorganisms as they metabolize dietary carbohydrates³³. The bacteria

primarily responsible for dental decay in man are *Streptococcus mutans*. This enzyme is considered to be of special importance in the establishment of dental plaque³⁴. So, it is best natural substance and its rating as second most popular daily consumption item in Asia, which contribute the best oral hygiene to oral cavity³⁵.

Antioxidant activity

Oxidative damage is an important effect of ionizing radiation on biological membranes. It is a chain reaction of free radicals generated from the radiolytic decomposition of water can attack fatty acid chains of membrane lipid. Presence polyphenols compounds like catechol, allylpyrocatechol in betel leaf extract inhibited the radiation induced lipid peroxidation process effectively. This could be attributed to its ability to scavenge free radicals involved in initiation and propagation steps³⁶.

Anti-allergic activity

The inhibitory effects of *Piper betel* on production of allergic mediators by bone marrow derived mast cells and lung epithelial cells were studied. The effects of *Piper betel* ethanolic extract on the production of histamine and granulocyte macrophage colony-stimulating factor (GM-CSF) by murine bone marrow mast cells (BMMCs) and on the secretion of exotoxin and IL-8 by the human lung epithelial cell line, BEAS-2B, were investigated in vitro. The extracts significantly decreased histamine and GM-CSF produced by an IgE mediated hypersensitivity reaction, and inhibited exotoxin and IL-8 secretion in a TNF- α and IL-4-induced allergic reaction. The results suggest that *Piper betel* may control of allergic diseases through inhibition of production of allergic mediators³⁷.

Antifertility activity

A study to develop an orally effective male contraceptive agent was extensively carried out in male mice with various doses of the leaf stalks extract of Piper betel. The result shows no toxicity in all metabolically active tissue of mice and interestingly, the contraceptive efficacy emphasized reversible fertility after withdrawal of treatment³⁸.

Neuropharmacological profile

Hydroalcoholic extract of betel leaves exhibited improvement in the discrimination index, potentiating the haloperidol induced catalepsy, reduction in basal as well as amphetamine induced increased locomotor activity and delay in sodium nitrite induced respiratory arrest. These results recommend promising facilitation of cholinergic spread and hanging-up of dopaminergic as well as noradrenergic transmission by the extract^{39,40}.

Pro-apoptotic Effect / Anti-Leishmaniasis

In a comparative in vitro anti-leishmanial activity of methanolic extracts from two landraces of *Piper betel*. The efficacy mediated through apoptosis is probably due to higher content of eugenol.

Cholinomimetic effect

Betel leaf rise in body temperature due to cholinergic responses. The leaves contain cholinomimetic and possible calcium channel antagonist constituents which may provide the basis for several activities shown by this plant.

Hepato-protective activity

The examination showed that the betel leaf extract protected liver from the damage induced by CCl₄ by decreasing alpha smooth muscle actin (alpha-sma) expression, inducing active matrix metalloproteinase-2 (MMP2) expression

through the Ras/Erk pathway, and inhibiting TIMP2 level that consequently attenuated the fibrosis of liver. These findings support a chemo preventive potential of betel leaf against liver fibrosis.

Anticoagulant Activity

The in vitro anticoagulant activity of *Piper betel* compound was obtained by the column chromatography was studied. It has been found that the phenolic compound present in the piper betel was responsible for the anticoagulant activity⁴¹.

Antiulcerogenic activity

Pretreatment of an ethanolic extract of leaf of *Piper betel* Linn at a dose of 200mg/kg body weight, orally administered to rats for ten consecutive days, was found to possess a significant protective action against gastric lesions induced by indomethacin. The extract was also found to possess both superoxide and hydroxyl free radical scavenging action. Further investigation showed the protective activity of allyl pyrocatechol (APC), which is the major antioxidant constituent of *Piper betel* against the indomethacin-induced stomach ulceration in the rat model. It was found that the excellent healing activity of ethanolic extract of *Piper betel* play a major role of mucin protection and regeneration in the healing of non-steroidal anti-inflammatory drugs mediated stomach ulceration³⁰.

Anti-Photosensitizer

Inhibitory property of the Piper betel phenolics against photosensitization-induced biological damages: PB phenolics, allylpyrocatechol (APC) may play a role in protecting biological systems against damage by eliminating O₂ generated from certain endogenous photo sensitizers⁴².

Anti-inflammatory activity

Piper betel was evaluated for acute and chronic anti-inflammatory study at a dose of 300 mg/kg leaf powder. Diclofenac sodium was used as the standard drug. Carrageenan and dextran models were studied for acute inflammation while cotton pellet induced granuloma was used for chronic inflammation study⁴³.

Radioprotective activity

Mammalian system if exposed to radiation can cause damaging effects leading to cell death and an increased risk of degenerative diseases. Recently the radioprotective property of ethanolic extract of *Piper betel* leaves was studied as alternative low cost preventive medicine to synthetic radio protectants which are reported to be toxic. The capacity of the extract in preventing g-ray induced lipid peroxidation and DNA damage in rat liver mitochondria were accessed and evaluated to establish the mechanism of its Radioprotective action. It suggests that the herb has a great potential not only it is cheap but also easily accessible natural radioprotectant to the common people.

Cytotoxicity / Anticancer Potential

Study evaluated an aqueous extract of leaves to cytotoxicity studies on Hep-2 cell line. The mean CTC50 was 96.25 ug/ml suggesting potent cytotoxicity and probable anticancer property⁴⁴.

Medicinal Applications^{9,45,46,6,47,48}

1. The paste of *Piper betel* leaves assorted with salt and hot water able to be administering for filariasis.
2. For curing obesity, one *Piper betel* leaf mix with *Piper nigrum* is prescribed for two months.
3. Juice of *Piper betel* with honey is accommodating to treat coughs,

- dyspnoea, and in indigestion, amongst children.
4. Leaves of *Piper betel* smeared with oil are useful on the breast of lactating women; it is supposed to promote milk secretion.
 5. A local application is recommended for inflammatory swelling such as orchitis, arthritis and mastitis.
 6. For childhood and old people, leaves are mixed with mustard oil, warmed and are apply to the chest for treatment to reduce cough and dyspnoea.
 7. Recovers bad breath, body odor and prevent tooth decay.
 8. Prevents and treats vaginal infection and reduce itching of the vagina.
 9. Stop bleeding in the nose.
 10. It contains vitamins such as thiamine, niacin, riboflavin and carotene.
 11. In India, leaves used for curing eczema, lymphangitis, asthma and rheumatism.
 12. Paste of leaves is applied on cuts and wounds.
 13. Roots with black pepper used to generate sterility in women.
 14. Oil used for irritation in throat, larynx, bronchi, gargle and inhalation in diphtheria.
 15. Juice of leaves is used as stomachic and febrifuge.
 16. *Piper betel* leaves are advantageous in pulmonary infection in childhood and old age. The leaves mixed in mustard oil warmed and applied to the chest to relive cough and intricacy in breathing.
 17. Limited application of the leaves is efficient in procuring sore throat. The flattened fruit or berry should be mixed with honey and used to reduce irritating cough.
 18. *Piper betel* leaves are helpful for the treatment of nervous pain, nervous exhaustion and debility. The extract of few betel leaves, with honey serve up as a good tonic.
 19. On applied locally *Piper betel* leaves are valuable in the treatment of swelling such as arthritis and orchitis i.e. inflammation of the testes.
 20. *Piper betel* leaves also shows analgesic and cooling properties.
 21. It is also a priceless remedy for boils. A leaf is lightly warmed till it gets soft, and then coated with a layer of castor oil. The oiled leaf is placed over the inflammation.
 22. A hot poultice of the leaves or their extract mixed with some bland oil as refined coconut oil which can be applied to the loins with beneficial results in lumbago.
 23. The leaves can also be used to heal wounds. The juice of the leaves should be extracted and applied locally to the wounds.
 24. The application of leaves coating with oil and said to encourage secretion of milk when applied over the breast during lactation.
 25. According to Unani system, these leaves have a sharp taste and good smell which helps to improve appetite.
 26. It also used as a tonic for brain, heart and liver.
 27. It also helps to promote healthy teeth and skin.
 28. It helps in procurement of Disorders in physiological function of body, Skin diseases and several Eye diseases.
 29. *Piper betel* leaves also contains diuretic property. Juice of leaves given with milk or honey helps in easing urination.
 30. *Piper betel* leaves is used in aphrodisiac i.e. an agent that stimulates sexual desire.
 31. The essential oils which contains in the leaves are antibacterial, antiprotozoal and antifungal properties. Therefore, the oil kills or inhibits expansion of outrageous bacteria causing typhoid,

cholera and tuberculosis etc. and helps in proper evaluation and exploitation.

32. The leaves are nutritive and hold considerable quantity of vitamins and minerals and therefore, six leaves with a small bit of slaked lime are said to be equivalent about 300 ml of cow milk mainly for the vitamin and mineral nutrition.

Side Effects of Piper betel when consumed with areca nut, catechu, slaked lime, and tobacco

Oral cancer is one of the most common non communicable diseases worldwide with an estimated increase of 275,000 new cases each year⁴⁹. Oral cancer is the term used for cancers that form in tissues of the oral cavity or the on pharynx⁵⁰. These along with other head and neck cancers are the sixth most prevalent type of cancer in the world^{51, 52} and one of the leading causes of death in developing countries^{53,54}. One of the major risk factors associated with the high prevalence of head and neck cancer and oral potentially malignant diseases in this region is smokeless tobacco⁵⁵. It is estimated that over 90% of the global smokeless tobacco use burden is in South East Asia⁵⁶; around 100 million people use smokeless tobacco in India and Pakistan alone. SLT is used in many forms varying from chewing tobacco not mixed with any other ingredient to a mixture of tobacco with other ingredients such as in betel quid, areca nut with tobacco, Naswar, paan-masala with tobacco⁵⁷. Smokeless tobacco contains around 28 known carcinogens. These include the nonvolatile alkaloid-derived tobacco-specific N-nitrosamine and N-nitrosamino acids as the major group while volatile tobacco-specific nitrosamines, volatile aldehydes, and some poly nuclear agents have also been shown to be present in smokeless tobacco^{58,59}. Irrespective of the

uses, betel vine is arguably the most maligned plant whose regular consumption is believed to cause cancer of the oral cavity. This infamous accreditation is principally due to the fact that habitual chewing of betel quid consisting of areca nut or betel nut (*Areca catechu*), betel leaf, catechu, slaked lime and often tobacco (*Nicotiana tabacum*) causes cancer of the oral cavity. However contrary to the accepted belief, scientific studies have shown that betel leaf is devoid of mutagenic and carcinogenic effect. Pioneering studies reported for the first time that aqueous extract of betel leaf failed to induce any tumor in mice in both Swiss mice and C17 mice thereby proving that unlike believed betel leaf was not carcinogenic. Subsequent studies by have conclusively shown that the betel leaf and some of its phytochemicals also prevented chemical induced cancers in experimental animals^{60,61}. Subsequent studies have shown that betel leaf was effective in preventing tobacco-specific nitrosamines the N²-nitrosornicotine and 4-(methyl nitrosamino)-1-(3-pyridyl)-1-butanone-induced carcinogenesis of tongues against the lower dose of the carcinogen N²-nitrosornicotine. Experiments with Syrian hamsters have also shown that the betel-leaf extract and two of its constituents, β -carotene and α -tocopherol were also observed to be effective in inhibiting the decreasing the incidence, reducing tumor burden, enhancing tumor latency period and to regress the established frank tumors. The combination of betel leaf extract with turmeric was also observed to be effective suggesting a cooperative effect between the two dietary agents^{62,63}. It's also proven in many studies that long time consumption of betel quid and the other ingredients consumed by *Piper betel* leaves can cause oral mucosa changed which lead to oral cancer⁶⁴.

DISCUSSION

Piper betel plant is rich sources of various nutrients as well as ample amount of phytochemicals and antioxidants found in it. The studies we compiled up here show its different properties to cure different-different disease like anticancer, antimutagenic, anti-amoebic, anti-giardial, anti-inflammatory, mosquito larvicidal, antimicrobial, immunomodulatory, anti-ulcerogenic, radioprotective, antileishmanial, antifungal activity. As well as it also cure bad breath, boils and abscesses, conjunctivitis, constipation, headache, hysteria, itches, mastitis, mastoiditis, leucorrhoea, otorrhoea, ringworm, swelling of gum, rheumatism, abrasion and cuts. It all possible due to presence of hydroxychavicol acetate, allylpyrocatechol piperbetol, isoeugenol, anethole, stearic acid, methyl eugenol, carvacrol, polyphenol, alkaloids, saponin, tannin and steroids in it. Studies also proven that *Piper betel* leaves have anti carcinogenic properties so the cause of oral cancer is not the betel leaves it actually due to the other carcinogenic containing ingredients.

CONCLUSION

Piper betel is very known to worldwide and consumed frequently as mouth freshener. These leaves are rich in nutrients, antioxidant, phytochemical and in many nutraceuticals properties but these are known to few people not to everyone. Removing the betel quid, areca nut, tobacco and other ingredients from the 'Paan' and having the leave with cardamom we can increase its beneficial part and reduce the side effects of it. Paper focuses on the beneficiary part of *Piper betel* plants. It is a traditionally used plant since antiquities as medicinally useful plant. So, we have to keep it using for curing diseases.

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Table 1. Classification of *Piper betel*

Classification	
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Piperales
Family	Piperaceae
Genus	Piper
Species	Betel

Table 2: Name of *Piper betel* in Various Languages

Indian Languages	Names
Sanskrit	Nagavalli, Nagavallari, Nagini
Hindi, Bengal, Gujraji, Urdu	Paan
Kannada	Vilya, Veeleya, Villayadel Konkani Phodi paan
Malayalam	Vettila, Vettillakkoti
Marathi	Vidyache pan
Tamil	Vettilai
Telugu	Tamalapaku
Other Asian Languages	
Vietnamese	Trầu
Arabic	Tanbol
Mon	Plu
Khmer	Maluu
Thai	Plue
Sinhalese	Bulath
Persian	Burg-e-Tanbol
Chamorro	Papulu
Malay	Daun sirih
Kapampangan	Bulung samat

Table 3: Nutritional composition of fresh *Piper betel* leaf^{d,11}

S. No.	Constituents	Approximate composition
1	Energy	44 kcal/100 g
2	Water	85-90%
3	Protein	3-3.5%
4	Fat	0.4-1.0%
5	Minerals	2.3-3.3%
6	Fiber	2.3%
7	Carbohydrate	0.5-6.10%
9	Nicotinic acid	0.63-0.89 mg/100g
10	Vitamin C	0.005-0.01%
11	Vitamin A	1.9-2.9 mg/100g
12	Thiamine	10-70 µg/100g
13	Riboflavin	1.9-30 µg/100g
15	Nitrogen	2.0-7.0%
16	Phosphorus	0.05-0.6%
17	Potassium	1.1-4.6%
18	Calcium	0.2-0.5%
19	Iron	0.005-0.007%
20	Iodine	3.4 µg/100g
21	Essential Oil	0.08 - 0.2%

**Figure 1:** Picture of betel leaves and areca nuts, saffron, clove.