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PIPER BETLE L.- A REVIEW

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Abstract- Betel vine (*Piper betle* L.) belongs to genus *Piper* of the family Piperaceae. Leaves of *Piper betle* posses several bioactivities and are used in traditional medicinal systems. Many research studies on *Piper betle* has reported that it contains important chemical constituents and are acts to arouse action for its medicinal properties like anticancer, anti-allergic, anti-malaria, anti-filarial**,** antibacterial, antifungal study, insecticidal, antioxidant, anti-diabetic, gastro-protective, cytotoxic, wound healing activity, chlorophyllase activity, oral hygiene and anti-asthmatic effect.

Key words: *Piper betle,* activity, diseases

INTRODUCTION

The most common are several varieties of leaves: Calcutta, Banarasi, Magahi, and so on. Bangladesh's best-produced districts are Dinajpur, Rangpur, Chittagong, Faridpur, Jessore, Narayanganj, Barisal and Sylhet. Both local and for sale to Middle East, European nations, USA, United Kingdom, Pakistan and Myanmar are utilized in the collected leaves. Paan is one of rural Bangladesh's main economic sources. The best Betel leaf is "Magadhi" (meaning from the region of Magadha), which is cultivated in Bihar, India in the vicinity of Patna. The famous type of betel leafs in Kerala is found in Venmony near the village of Chengannur. Betel leaves are of good quality grown in Tirur, Kerala, Hinjilicut and Odisha. The export of Betel leaves from Tirur in Pakistan is known as the Tirur Pan. Piper betle is one of the most precious herbs used for therapeutic applications in its leaves. Piper betel is also recognized in India as a part of the vast plant family of Piperaceae, and in Malaysia and Indonesia as Paan is known, shown in figure 1. Since ancient times, the fresh betel leaves have been wrapped with areca nut, mineral slaked lemon, catechu, flavoring materials and spices[1].

As a possible therapeutic agent, medicinal plants have been demonstrated with increased resistance to frequently used antibiotics and the development of new infectious illnesses. Ethno-medicines have traditionally been utilized all throughout India, because of low cost, ease of availability and lower side impacts[2]. The Piper betle leaf extracts are found to be beneficial against many infections in humans[3]. Piper betle is a medicinal herb used as a vaginal or oral candidiasis by Indonesians. The Piper betle leaves extract includes a variety of bioactive compounds, a preliminary investigation found. Biologically active chemicals, the concentration of which is based on plant, season and climate diversity, are found in piper betles. A novel approach to acquire an antibacterial component without needing to extract from medical plants was by using bacterial endophytes from medicinal plants[4]. Many researchers have provided a great number of important information on Piper betle

and its activities, including cancer, anti-allergic, anti-malaria, anti-filarial, antibacterial, anti-fungal, insecticidal, anti-diabetic, anti-gastroprotective, cytotoxic, anti-platelet, injury healing, chloropyllase, oral hygiene, asthma effects, etc. [5, 6, 3].

The plant components of pan were extracted using solvents such as ethanol, methanol, chloroform, n-hexane, ethyl acetate and dichloromethane, acetone, petroleum ether, benzene and water distilled[7]. Chemical study of the Piper betle leaf stem, which was also investigated by Dwivedi and Mehta in 2011, and its structures were spectroscopically and chemically determined[8]. Mishra and Gaur of the Bhabha Atomic Research Center, Bombay, India studied Piper betle L's work during the beginning of the 70's. Her research was conducted on "the role of the little leaves' of Betel's (Piper Betle L.) protein metabolism.' The quantity of chlorophyll and proteins and extent of protein synthesis decreased in normal pétiole leaves, whereas man recorded protease activity folds with the progression of senescence.

All these variations are retarded without altering the main pattern of senescent therapy due to depetiolation de-midribbing. Thus, Petiole appears to accelerate breakdown of protein [9, 10]. The inhibitory properties of Piper betle extract against photosensitization caused lipid and protein damage have been studied at Bhattacharya et al., 2006. The protective activity of Piper Betle and ethanol extract against the lipides and proteins in rat liver mitochondria caused by photosensitization was studied and it was found, by measuring thiobarbituric acid reagents, lipid hydroperoxide and conjugated diene, which could effectively prevent the lipid by oxidization[11]. They studied the preservation of Piper species by means of vacuum dryer methods and found the vacuum drying process was expedited by raising drying temperature, together with increasing vacuum pressure. The color changes depended on the drying temperature, where the temperature was higher and the product was darker compared to the lowest one [12].

The fresh leaves contain: humidity 85.4, proteins 3.1, fat 0,8, carbohydrates 6.1, fiber 2.3, calcium 230mg, phosphorus 40mg. They contain a high potassium nitrate concentration (0.26- 0.42 percent). Glucose, fructose, maltose and sucrose are among the sugars found in betel leaves. The average sugar reduction percentage varies from 0.38 to 1.46 per cent in the different kinds of betel leaves. The enzyme, like diastase and catalase, is also found there. (K.Periyanayagam1). Betle piper leaves are claimed to have anti-cancer properties previously.

Thus, cytototoxicity tests on Hep-2, Micro culture Tetrazolium and B-assays on the aqueous extract of the leaves have been conducted (Chaurasia, Sundeep et al). Piper betle leaf oil may be used to produce pharmaceuticals, fragrances, food additives, etc. as industrial raw material. The leaves include anti-carcinogenic substances that are promising to make blood cancer medicine (Sengupta).

Scientific Classification[13]

Synonyms:	Chavica Beta. Artanthe Hixagona Fingdom: Plantae
Order:	Piperales
Family:	Piperaceae
Genus:	Piper
Species:	P.Petle
Test:	Pungent tasting and warming.
Division:	Magnoliphyta

Vernacular Names

Sanskrit:	Tambool, Mukhbhushan, Varnalata
Hindi:	Paan leaf, English: Betle, Betle pepper, Betle-vine
Telugu:	Nagballi, Tamalapaku

Tamil: Vetrilai Gujarati: Nagarbael

Bengali: Paan, Paana, Tambulaballi (plant), Parnakari (leaf).

Assamese: Paan, Paana.

Kannada: Eleballi, Panu, Vileyadele

Gujarati: Paan, Tanbolaa

Malayalam: Vettila

Nepalese: Naagavallii (plant), Paan (leaf).

Indonesia: Bakik serasa, Daun sirih, Sirih, Serasa, Séwéh, Seureuh.

German : Betelpfeffer, Betel-Pfeffer

Chinese : Ju jiang, Tu bi ba, Tu wei teng, Wei zi, Wei ye, Da geng teng, Ch'ing Chu.

Figure 1: Piper Betel Pant

Physical Characters

A bluish-green wine which is quite similar to pepper in growth behavior as a ground cover or a tiny climber. The betel leaf plant is a branched wine that may rise to 10-15 ft, but generally grows as a soil cover. It is usually too delicate to cultivate beyond the tropics. The environment of the plant growth favours warm, wet circumstances although some drought tolerates. The bait leaf is used to cure stomach aches, infections and a general tonic with a number of traditional treatments. The betel nut (Areca catechus) is commonly consumed in combination as a stimulant. There is some evidence that bait leaves contain both immunological and anti-boosting effects as well as anti-cancer properties.[14]

Nutritional Composition

The proximate analysis of the leaves of Piper betle showed that it contained macro and micro nutrients as well as phytochemical shown in table 1.[15]

TRADITIONAL USE

The Betel (Piper Betle) plant is a secondarily used plant that includes secondary metabolites. This betel plant was introduced approximately 2.500 years ago in the region of Malesia and in tropical Asia in Madagascar and East Africa, and is endemic to central and eastern Malesia. In Southern India and Southern China, imported by Europeans in XVth century, this kind of betel also develops and spreads.[16]

Piper betle leaves have traditionally been used in India, China and Thailand for the preventive use of breathless breaths due to antibacteria, their mouth freshening and chewing properties, their wound healing properties, digestive activity and the stimulation of pancreatic lipases, cataracts and lung disease prevention and secretion, bleeding and aromatic stimuli.[17]

The betel leaf extract is frequently used in Ayurveda as an adjuvant and can, besides using a single medication, be combined with various drugs for greater results. The betel leaf used as a sound, laxative and appetite-friendly fragrance. In addition, ancient literature showed the aphrodisiac impact of the eating betel. Betel is also said to enhance liver power and control blood flow. Highlighted in numerous areas is its anti-inflammatory and antibacterial usefulness. In Ayurveda, it works as a suppressor of Vata and Kapha. Betel leaf also helps to remove mucus from the airflow due to possible heat from the leaves. According to the Greek method, this taste and scent are good for increasing appetite and taste, for tonics of the brain, heart and liver, for lowering taste, for clearing the throat and purifying the blood.[18]

Betle Piper leaves are also used to stop the bleeding nose by taking two pickled, rolled-up and then placed Piper betle leaf sheets in the nostril.[19] Piper betle is frequently used as medication, particularly for infections with fever, wounds, eyes.[20]

Table 1: Elemental composition of Piper Betel Linn

Sr. No.	Constituents	Approximate	Composition
1	Water	85-90%	
2	Protein	3-3.5%	
3	Fat	0.4-1.0%	
4	Minerals	2.3-3.3%	
5	Fiber	2.30%	
6	Chlorophyll	0.01-0.25%	
7	Carbohydrate	0.5-6.10%	
8	Energy	44	kcal/100g
9	Essential Oil	0.08 - 0.2%	
10	Iodine	3.4	µg/100g
11	Iron	0.005-0.007%	
12	Calcium	0.2-0.5%	

13	Potassium	1.1-4.6%	
14	Nicotinic acid	0.63-0.89	mg/100g
15	Vitamin C	0.005-0.01%	
16	Vitamin A	1.9-2.9	mg/100g
17	Thiamine	13-70	µg/100g
18	Riboflavin	1.9-30	1.9-30
19	Tannin	0.1-1.3%	
20	Nitrogen	2.0-7.0%	
21	Phosphorus	0.05-0.6%	

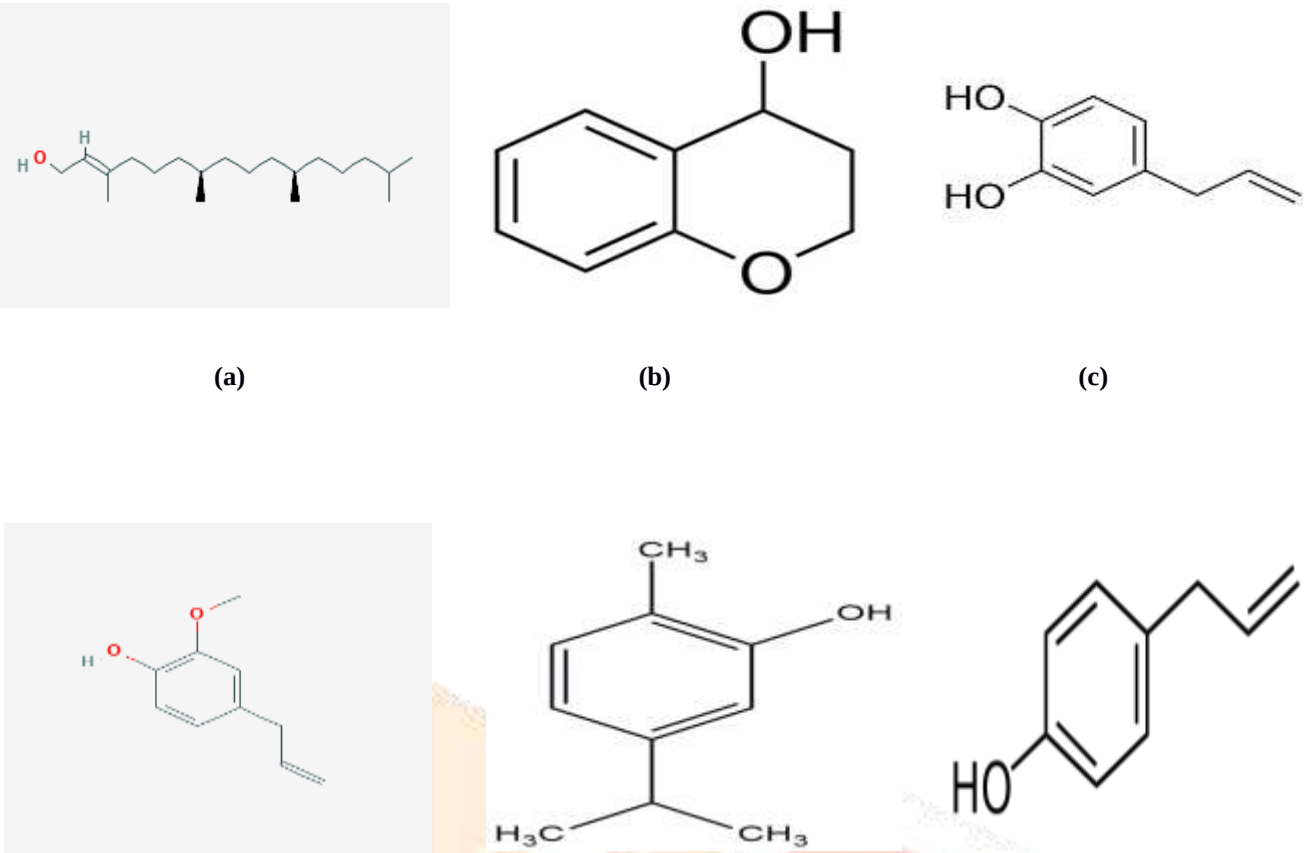
Phytochemicals in Betel Leaves

Betel Leaves Extract (BLE)

Betle piper includes a variety of phytochemicals according to their plant origin and the solvent used to extract them. A preliminary phytochemical study of betel leaves from Malaysia has shown that the water extracts of betel leaves include alkaloids, tannins, glycosides, sugar reduction and saponins[21]. In addition, the overall phenol, flavonoid and tannin content in Mauritius betel leaf extracts was evaluated by an investigation[22]. In acetone, dichloromethane and ethanol extracts, respectively, the greatest total phenol, flavonoid and tannin were observed. Betel leaves from Tamilnadu, India include, but are not present in the form of alkaloids, steroid samples, tannins, proteins, amino acids, flavonoids, terpenoids, mucilage, saponin, carbohydrates and fixed oil[23]. In addition, several investigations have effectively insulated BLE-bioactive substances such as phytol, acyclic alcohol diterpene, 4-chromanol, 4-lylpyrocatechol, and allylpyrocatechols 1 [24-27].

Betel Leaves Essential Oil (BLEO)

The Betelian leaves are categorized as monoterpenes, sesquiterpenes, phenyl- propanoids and aldehydes with 0.15 to 0.2% essential oil. The components of BLEO depend heavily on their botanical origin, plant age and time of harvest. The fragrance, taste and bioactivity of BLEO can be affected by many compounds[28]. GC-MS BLEO's study from various sites in India has shown that main components include phenylpropanoid groups such acetyl eugenol, eugenol, chavicol and safrole[29]. Indian BLEO produced from a cultivar of Sagar Bangla contains chavicol, but not from a cultivar of Magahi. The research also found that BLEO contains eugenol (40%) and a mixture from carvacrol and chavicol (up to 40%), as shown in Figure 2. In addition, additional major com-pounds, including estragole, linalool, al-copaene, anethole, and caryophyllene α-terpinol, P-cymen, 1,8-cineole, β-caryophyllène, α-humulin, allylcatechol, methyl eugenol, estragol, chavibettol, chavibetol, safrol, 4-allyl-2-methoxy-phenolacetate and 3-allyl-6-methoxyphenol, were found. Meanwhile, another study found additional primary compounds. [28,30,31]



(a) **(b)** **(c)**

(d) **(e)** **(f)**

Figure 2: Major bioactive compounds in betel leaves extracts and essential oil. (a) phytol; (b) 4- chromanol; (c) hydroxychavicol; (d) eugenol; (e) carvacrol; (f) chavicol

Various proved activities of *Piper betle*

Anticancer activity

Clinical research and laboratory investigations have proven that many human illnesses, including cancer and tumor, have been caused by persistent inflammation.[32, 33, 34] The betel leaf was used for mouth irritation as a traditional household treatment. [35] Oral cancer was one of the 10 most frequent malignancies with over 90% of it recorded in South-East Asia, where cigarette and smoking are popular. One study by Rao (1984) showed that B(a) P—induced oral carcinogenesis was suppressed by topical administration of betel leaf extract in hamsters.[36] It was also discovered that the combination of betel extract and turmeric between two foodstuffs is beneficial.[37] Catharanthus roseus, Dendrophthe pentandra and Curcuma manga extracts from breast cancer cell lines were examined by Widowati et al., 2013, as well as the free radical scavenging potential of Cataranthus roseus.[38] Rai et al., 2011 reported cancer prevention of Piper betle.[39] In addition to the betle leaf extract in drinking water, the concentration dependant neoplasm benzo(a) caused by pyrene in mice considerably decreased.[40] The Piper betle leaf extracts contain antiviral and chemo-preventive properties and may thus be utilized to treat different disorders such as human lung cancer.[41]

Anti-allergic activity

The inhibitional effects of Piper betle on the formation of bone marrored cells and lung epithelial cells of allergy mediators were worked out by Wirotesangthong et al., 2008. The results imply that Piper betle can provide a new treatment method for controlling allergic disorders by inhibiting allergic mediator production[42]. The objective of an antiseptic was to remove or decrease the quantity of operative germs at the time of operation. Amalia et al. evaluated and effectively used the Piper beta leaf

in patients with cataract pre-operation in 2009 [43]. In order to assess antihistamines, Hajare et al, 2011 used the leaf extract of Piper in guinea pig[44].

Anti-malaria activity

Anopheles stephensi and Culex fatiga were more effective in protecting against bite than recognized mosquito-producing citronella oil in essence of Piper betle. When sprayed at a rate of 20 µl/sqm (4 hours) Piper betle oil protected the Anopheles and Culex tiredness with a maximum of 2,2 and 2,6 hrs as citronella oil. Therefore, pan mosquito repellents have been proven[45].

Anti-filarial activity

The antifilarial activity of Piper betle was studied in Singh et al., 2009. The research outlined the n-hexane and chloroform fractions of Piper betle L. activate several arms of BALB / c mice immunological reactions and demonstrate antifilarial activity in human lymphatic Brugia Malayi. [46]

Antibacterial activity

Medicinal plants' antibacterial capabilities have been recorded from throughout the world and are utilized in the treatment of various ailments such as malaria, AIDS and sexually transmitted disease[47]. The crude aqueous extract of Piper betle L. and its antibacterial activity on Streptococcus mutans was reported by Nalina et al. in 2007. The ultrastructural and acid-producing characteristics of Streptococcus mutans are the focus of antibacterial actions. From the TEM, it has been found that the crude Piper betle L leaves extract induces membrane damage to the plasma cell and nuclear coagulation. The extract has considerably decreased the bacterial acid-generating capabilities and altered to Streptococcus mutans ultra-structure [48]. Also described is antimicrobial action.

Antifungal study

Anti-foungal activity was developed by Ali et al. in 2010 and 124 strains of chosen fungi were used to perform antifungal research in vitro and isolated from chloroform extraction of the aqueous piper-bettle L extract[49]. In vitro tests have been carried out in Malaysia on the antifungal activity. The results revealed that Piper betle gave the greatest result in antifungal susceptibility tests and that 4 out of 5 strains of fungi have antifungal activity. Piper betle was employed to extract Solid Phase (SEP) to initially separate the active antifungal component in the form of methanol fractions. Piper Betle thus demonstrated Tichophyton rubrum the greatest antifungal activity.

Insecticidal activity

Cristina et al., 2006 have studied the insecticidal effects of Piper betle essential oil against insect pest storage. The insecticidal activities of the essential oil obtained from the leaves of Piper betle L. have been tested with a range of old grain tests against the weevil (Callosobryst Maculatus F). The therapy efficiency was measured by assessing the acute toxicity of adult insects and the extent to which progeny generation has been prevented or suppressed. The bio-active component of Piper betle oil can therefore have ovicidal effects that have prevented the development of C. maculates eggs into larvae. Thus, the adult stage did not arise. The study reveals that Piper betle leaf oil is an agent that reduces fertility in adult S. zeuve and R. domica. The ovicidal action of the oil is equally unavailable. Essential Piper betle leaves were recommended to be a prosperous protective grain.[50]

Antioxidant activity

The use of high antioxidant diet will assist prevent or delete the oxidative damage of lipids, proteins and nucleic acids[51] by neutralizing free radicals in the body. The use of antioxidants has been demonstrated to lower cardiovascular mortality[52, 53] and to reduce the risk of being protected from cancer and other chronic illnesses[54, 55].

Anti-diabetic activity

Kaleem *et al.*, 2005 suggested that *Piper betle* used effectively in the treatment of diabetes. The antidiabetic properties of some plants like Bitter gourd (*Momordica charantia*), Neem (*Azadirachta indica*), Tulsi (*Ocimum sanctum*), and Garlic (*Allium sativum*) are known in India. In Piperaceae family *Piper sarmentosum, Piper longum, Piper nigrum* and *Piper betle* are identified as potential antidiabetic agents[56].

Gastro protective activity

The Sri Lankan Piper Betle leaf mines in rats were investigated in 2004 by Arambewela et al. The Hot Water Extract (HWE) and Cold Ethanolic Extract (CEE) at 3 different doses (200, 300 and 500 mg kg — 1) are used to assess the gastric protective effect of the two components in rats to cause ulcer. HWE and CEE oral administration provided information on a dose-age-dependent activity and substantial protection against stomach injury due to absolute ethanol. The HWE raised (by 49%) the mucus content that is attached to the gastric mucosa wall substantially. The maximum dose of HWE was not a major acidic (total as well as free) or pH acidic inhibition in this research.[57-59]

Cyto-toxic activity

Roy andVijayalaxmi,2013 have investigated the cyto-toxic activities of ethanolic extract of Piper betle leaves by applying MTT test and Trypan- Blue dye exclusion technique to murines (Ehrlich Ascites Carcinoma B-16 cells) and human (Hela, Raji) cell lines. The results showed that concentration-dependent cell death occurred in several cultured cell lines. Although Piper betle had both normal and tumor cell line cyto-toxicity, the tumor cell toxicity was much larger than normal cells which showed a selective toxic impact on the tumor cells.[60]

Wound healing activity

Nilugal et al., 2014 examined the assessment of wound healing of Piper betle leaves and stem extract in experimental wistar rats. Wounds are known as natural anatomical structure and function disturbance. Wounds Wound healing was an extremely complicated multifactor event sequence involving several cell and metabolic processes. The results indicated wound healing and repair, speededed up by the application of ointment formulation with Piper Betle leaves and stem extract which was emphasized by an ordered epidermis covering the whole wound area thickness.[61]

Oral hygiene

Bissa et al., 2007 reviewed oral hygiene and found that the synergistic impact of the combination of betel blade, cadamom and clove is causing the oral microbial population. Dental caries had a normal oral flora-caused persistent endogenous infection. Streptococcus mutans are the main causes of tooth decay in humans. Streptococcus belongs to four groups of species: mutans, salivarians, anginos and mites. Lactobacillus acidophilus bacteria are probably a small factor in acid generation in a plaque in addition to Streptococcus mutans.[62]

Conclusion

This study indicates that Piper betle L. leaves contain a number and are a source of different phytoconstituents for medicinal reasons. Additional crucial leaf extract research should thus be required to improve their usage in diverse medicines. Betel vine is damaged during cultivation by several diseases which causes considerable farmers loss. Therefore, early detection of the disease needs to take preventative measures before the sickness starts to spread.

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