

Betelvine (*Piper betle* L.) an Asian Plant with Numerous Therapeutic Values: A Brief Review

Deepali Shukla, Poonam C. Singh, Ashmita Tandon and Jayandra Kumar Johri*

CSIR-National Botanical Research Institute, Rana Pratap Marg, Lucknow-226001, INDIA

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*Corresponding author:

Dr. Jayandra Kumar Johri

Mobile: +91-9451543736

Email: jjohri2009@gmail.com

Abstract

Betelvine (*Piper betle*) is a perennial, dioecious evergreen creeper belonging to the family *Piperaceae*. It is considered as a cash crop in India, mainly used for chewing purpose. Medicinal properties of betel leaves are known since 600AD and recorded in Ayurveda. Leaves of betel is a rich source of Phenolic compounds (Eugenol, Hydroxychavicol, β -Carotene and Ascorbic acid) which shows strong antioxidant properties that play a key role of several therapeutic mechanisms, Apart from Ayurveda, modern research also proves the medicinal properties of betel leaf and its compound shows anticarcinogenic, antidiabetic, antimicrobial, antifertility and several other therapeutic and nutraceuticals properties. In this review a brief account of medicinal importance of *Piper betle* is described.

1. Introduction

Betelvine (*Piper betle* L.) commonly known as Paan is perennial, dioecious evergreen creeper which belongs to family *Piperaceae*. It is native of Malaysia and grows well in many parts of India and Southeast Asia in shady and moist condition. It constitutes an important and popular cultural activity in many Asian and Oceanic countries, including Myanmar, Cambodia, the Solomon Islands, Thailand, the Philippines, Laos, and Vietnam. Betelvine is cultivated mainly in moist, tropical and sub-tropical regions and its leaves are mainly used for chewing. It is an important cash crop, and grown in about 54,000 ha. In India and around 2.5 lakh farming families earn their livelihood chiefly from betel leaf cultivation. The heart shaped glossy leaves of betel are auspicious, blessed with virtues hence have an esteemed position in India. The ancient texts like Charaka, Sushruta Samhita and Astanga Hridayam call betelvine by names - Nagavalli (a vine which creeps like a Naga or serpent) and Sapthashira (a leaf which contains seven veins) (Toprani and Patel, 2013). Betel leaves commonly known as 'Paan' are highly aromatic and rich in nutrients. Paan is a treasure of bioactive chemical compounds of pharmaceutical significance

therefore sometimes called as 'Green Gold' of India. Indians have a custom of offering "Paan" post-prandial to guests. The chewing of betel leaves prevents bad breath (halitosis), improve vocalization, and strengthen gum and teeth. It facilitates digestion, increase salivation and strengthens heart (cardio tonic), accelerates heart activity and regulates irregular heart beat and blood pressure (Kumar *et al.*, 2010). The culture of chewing betel leaf has a long history and is firmly rooted in Indian civilization.

2. Medicinal Properties of Paan (Betelvine)

Piper betle contains enormous medicinal properties. Leaf extract of Paan induces several mechanisms in human body which play significant role in healing the different diseases and also boost up immune system (Fig. 1). In this chapter a brief account of therapeutic properties of betelvine (*Piper betle* L.) are discussed.

2.1. Antimicrobial property

Betel leaf consist miraculous antimicrobial properties against numerous human pathogenic microbes like bacteria which are responsible for several deadly diseases (Datta *et al.*, 2011) and pathogenic

fungi like several dermatophytes or keratinophilic fungi (Nazmul *et al.*, 2013). Some nematocidal activity are also reported from betelvine (Premachandra *et al.*, 2014). For the antibacterial activity of betel leaf several bioactive compounds like sterols and phenolic (Chakraborty and Shah, 2011) are responsible which are present in betel leaf. It was proposed that these bioactive compounds alter the structure of cell wall of bacteria and disrupt the cell membrane which leads to degrade the bacterial component (Polya, 2003). Mechanism behind antifungal and antinematocidal activity is still unknown. Besides antibacterial and antifungal activity *Piper betle* also shows the antiprotozoal (Yamin *et al.*, 2013) activity, and ethanolic extract of *Piper betle* exhibited leishmanicidal activity (Kumar *et al.*, 2010) (Table 1).

2.2. Gastroprotective nature

Leaf of betelvine is a rich source of several bioactive compounds like Eugenol, Saffrol which exhibit a potential antioxidant property (Rathee *et al.*, 2006) and it was proven that antioxidant is responsible for inhibition of progression of gastric ulcers and protects

gastric mucosal injuries. Allylpyrocatachol of Paan shows potential antioxidant activity in different *in vitro* models (Bhattacharya *et al.*, 2007). Allylpyrocatachol takes a dominant part in ulcer healing process by increasing the mucous production, some other compounds of betel leaf like Chatechol inhibit the lipid peroxidation process induced by radiation betel leaf extract shows strong free radical scavenging activity that play important part in gastroprotective activity (Alam *et al.*, 2013).

2.3. Anticarcinogenic nature

Some of the research shows that betelvine is a cause of malignancy (Mori *et al.*, 1979), Pioneering studies by Bhide *et al.* (1979) reported for the first time that aqueous extract of betel leaf failed to induce any tumor in mice (both Swiss mice and C17) mice thereby proving that unlike believes betel leaf was not carcinogenic (Bhide *et al.*, 1979). Areca nut contains alkylating agents that cause mutations in DNA. The carcinogenic components in areca nut are present in sufficient amount to cause DNA damage increasing oral cancer among betel chewers. Paan has β -carotene, α -tocopherol, eugenol, hydroxychavicol and wealth of

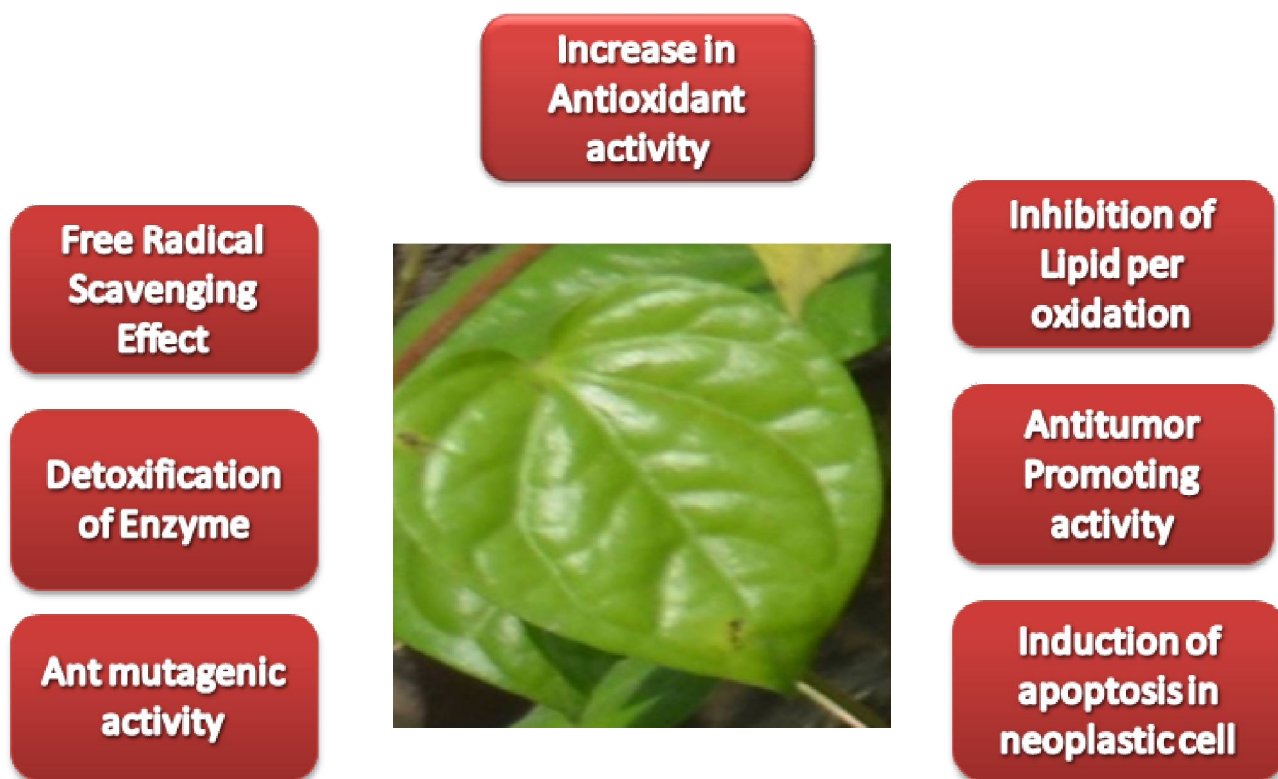


Fig. 1: Therapeutic mechanism induced by *Piper betle*.

Table 1: Antimicrobial property of betelvine against different pathogen.

S.N.	Pathogenic Microbe	Nature of Pathogenisity	Reference
1.	<i>Streptococcus pyrogen</i>	Pus forming pathogen	Caburian and Osi (2010)
2.	<i>Staphylococcus aureus</i>	Pus forming pathogen	Datta <i>et al.</i> (2011)
3.	<i>Enterocococcus faecalis</i>	Enteropathogen	Salam <i>et al.</i> (2014)
4.	<i>C. koseri</i>	Enteropathogen, Oral pathogen	Pradhan <i>et al.</i> (2013)
5.	<i>C. fruendi</i>	Enteropathogen	Annamalai <i>et al.</i> (2016)
6.	<i>Klebsiella pneumonia</i>	Enteropathogen	Datta <i>et al.</i> (2011)
7.	<i>Proteus vulgaris</i>	Enteropathogen	Bangash <i>et al.</i> (2012)
8.	<i>E. coli</i>	Enteropathogen	
9.	<i>Pseudomonas aeruginosa</i>	Enteropathogen	Khan and Kumar (2011)
10.	<i>Trichophyton sp., Microsporum sp., Epidermatophyton sp.</i>	Skin Infection	Garg and Jain (1992)
11.	Antiprotozoal activity	Stomach infection	Dwivedi and Tripathi (2014)
12.	Antihelminth activity	Stomach infection	Nair and Chanda (2008)

other chemical compounds which are anticarcinogenic, antimutagenic and chemo preventive. These compounds decrease tumor formation and modulate the carcinogenic effect of nitrosamines [N'-nitrosornicotine and 4-(methyl nitrosamino)-1-(3-pyridyl)-1-butanone], major carcinogens present in tobacco (Fazal *et al.*, 2014). Paan chewing reduces benzopyrene-induced gastric carcinogenesis and gastric ulcers (Kumar *et al.*, 2010). It is evidences that betel leaf itself has no carcinogenic activity combination eth areca nut and slaked lime have malignant properties betelleaf have a remarkable anticarcinogenic potential (Hussain *et al.*, 2011) (Table 2).

2.4. Antiinflammatory property

Leaf of betelvine was used as antiinflammatory agent since ancient time, research shows it was household remedy for oral inflammation (Satyawati *et al.*, 1987). It was reported that leaf extract of *Piper betle* posses antiinflammatory activity against *in vitro* model (Pin *et al.*, 2010), research also reveals that PBL extract (betelleaf) also down regulate T-helper cell mediated pro-inflammatory responses (Ganguly *et al.*, 2007).

2.5. Antidiabetic nature

Aqueous Extract of betel leaf shows remarkable hypoglycemic activity in normoglycemic rat model (Syiem *et al.*, 2002), betel leaf extract reduce the external glucose load in glucose tolerance test, betel leaf suspension inhibit the activity of Liver glucose-6-phosphate and Fructose-1,6-bisphosphate and

significantly reduces the blood glucose level and experiment in diabetic rat models suggested that PBL extract has insulinomimetic activity (Arambewela *et al.*, 2005).

2.6. Radio protective activity

Ethanolic extract of betel leaf extract exhibits the radioprotectant activity. It effectively prevent radiation induced lipid peroxidation, component of betel leaf Chavibetol and Allylpyrocatacol play important role in radioprotective activity (Prabu *et al.*, 2012).

2.7. Cardioprotactive activity

Piper betle leaf extract also works as cardi tonic as it has the platelets inhibition activity (Chang *et al.*, 2007) which is important in prevention of several cardio vascular diseases due to intravascular thrombosis (Jeng *et al.*, 2002). Betel leaf extract regulates irregular heartbeat, provide strength to heart. After chewing betel leaf it was observed that it accelerate cardiac activity, sweating and salivation and it also shows vasorelexant activity (Runnie *et al.*, 2004).

2.8. Antifertility activity

Some research reveals that root extract of betel have some steroid like diosegnin which shows ant fertility or ant estrogenic nature (Tewari *et al.*, 1970).

2.9. Immunomodulation activity

Piper betle also has a potential as an immunomodulatory effect (Majumdar and Islam, 2013).

Table 2: Betelvine in prevention of different type of cancer.

S.N.	Role of Betel in different Cancer	Betel compound responsible in anticarcinogenic nature	Reference
1.	Prevention in Oral Carcinogenesis	β -Carotene, α -Tochoferol	Chiba (2001)
2.	Prevention in Gastric Cancer	β -Carotene, α -Tochoferol, Eugenol	Rai <i>et al.</i> (2011)
3.	Prevention of Skin Cancer	β -Carotene, α -Tochoferol, Eugenol, Hydroxychavicol	Stich <i>et al.</i> (1984)
4.	Prevention of mammary cancer	β -Carotene, α -Tochoferol, Eugenol, Saffrole	Manoharan <i>et al.</i> (2009)
5.	Prevention of Prostate cancer	β -Carotene, α -Tochoferol, Eugenol, Saffrole	Rai <i>et al.</i> (2011)

3. Cholinomimetic Effect

Studies on guinea pig shows that betel leaf extract led to rise in body temperature (Garg *et al.*, 2014) by its cholinergic response, and other type of response also shown by this (Gilani *et al.*, 2000).

3.1. Hepatoprotective property

Study on rat model reveals that betelvine also consist Antihepatotoxic activity (Young *et al.*, 2007) histological examination of rat model shows that Betel Leaf extract give rise in antioxidant enzyme like Superoxide dismutase and Catalase by inhibiting the activity of Aspartate amino transferase (AST) and Alanine amino transferase (ALT) (Fathilah *et al.*, 2010).

4. Conclusion

As discussed above in review that betelvine is an important Ethanobotanic herb with numerous therapeutic values. The leaf of *Piper betle* is a magic bundle as it has great antioxidant potential which plays important role in several anticarcinogenic properties, antihepatotoxic nature, cardiovascular acceleration (Radhika *et al.*, 2013); several phenolic compounds found in betel leaf like Hydrodychavicol, Eugenol, Saffrol, etc have important medicinal properties like antidiabetic, antiarthritis, antiinflammatory (Sarkar *et al.*, 2008). Beside these betel leaves extract has a great antimicrobial potential and shows antibacterial, antifungal, antiprotozoal, and nematicidal activity (Premachandra *et al.*, 2014). Other than leaf betel root also shows antifertility nature (Dwivedi and Tripathi, 2014). *Piper betle* also shows immunomodulatory activities so it is concluded that it is a nature's gift to the humanbeing.

5. Future Perspectives

Herbs are human friends from the ancient year and now a day in the era of several critical problems like

MDR-Microbes and Cancer which are very dreadful to human society hence there is need to develop the herbal formulations. Betelvine have extensive therapeutic potential, it shows promising mechanisms for several diseases if focused research will be perform on Paan (betelvine) that would be a milestone in medical research field.

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