Journal of Cardiovascular Disease Research
ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 11, 2024

Original Article

Role of Betel Leaf in Oral Health: A Systematic Review

Kavya Dave[1]*, Dr. Nikita Patel[2], Dr. Pragnesh Patani[3]

[1]*Student, Khyati College of Pharmacy, Palodia, Ahmedabad, Khyati College of Pharmacy

[2]Assistant Professor, Khyati College of Pharmacy, Palodia, Ahmedabad, Khyati College of Pharmacy

[3]Principal and Professor, Khyati College of Pharmacy, Palodia, Ahmedabad, Khyati College of Pharmacy

***Corresponding Author:** Kavya Dave
*Khyati College of Pharmacy, Palodia, Ahmedabad, Email: kavyadave026@gmail.com.

Abstract
Piper betel L . comes in family Piperaceae. Piper betel or Betel vine deep heart shaped. This Betel leaf widely shown in Sri Lanka, India, Thailand, Taiwan and other Southeast Asian countries. Betel leaves are a great source of vitamins, minerals, phytochemicals, antioxidants, protein, lipids, fibre, calcium, iron, and many other nutrients. Many research studies on Piper betle have reported that it contains important chemical constituents such as chavibetol, chavibetol acetate, caryophyllene, allylpyrocatechol diacetate, campene, chavibetol methyl ether, eugenol, a-Pinene, f-Pinene, u-Limonene, saprobe, 1-8-cineol, allylpyrocatechol monoacetate etc. The leaf extract and purified compounds are found to play a vital role and are of immense benefits in oral hygiene, anti-diabetic, cardiovascular, antiinflammatory, and anti-ulcer. The active compounds isolated from leaf and other parts have great therapeutic role. It is a cash crop for many under developed Southeast Asian countries and therefore also known as “Green Gold and Green Heart". This review states the Introduction of Betel leaf in Oral cavity and mainly used for mouth ulcers.

Keywords: - Oral cavity, Betel leaf, Chemical constituents, Benefits of Betel leaf, Traditional uses.

Introduction

Oral Health

The oral cavity reflects the overall health of the body, including hydration levels and the condition of other organs[1]. Bacteria in the oral cavity can enter the bloodstream through small abrasions or trauma caused by food, brushing and flossing teeth, self-inflicted injuries like biting the tongue or lips, or using toothpicks[1]. The most significant diseases linked to an oral-systemic connection include cardiovascular disease, pulmonary disease, diabetes, orthopedic implant failure, and kidney disease[1]. Mostly Betel leaves are used in Oral ulcers. Oral ulcers are a common disorder affecting the oral mucosa membrane[2]. Mouth ulcers, also known as canker sores, are painful sores that appear on the gums and inside the mouth[2]. While generally harmless, they can cause significant discomfort, making it difficult for some people to eat, drink, or brush their teeth[2]. The oral cavity is a crucial part of the human body, serving as an accessible and invasive anatomical site. It has direct connections to both the digestive and respiratory systems, playing a key role in maintaining overall health.[3,4,5]

Different Herbs used in Oral Health

- **Aloevera:-** This tropical plant is cultivated over most of Asia and North Africa. The compounds that make up aloevera are Saccharides and Anthraquinones, Fragrance oils and prostaglandins. That's antiseptic, analgesic, antiviral, antifungal, and antibacterial.[6,22,23]
- **Peppermint (*Mentha piperita*):-** This specific mint variety thrives in moist environments, featuring dark green, lance-shaped leaves and purple flowers. Peppermint leaves produce approximately 0.1-1.0% volatile oil. The plant contains menthol, methyl acetate, tannic acid, and vitamin C. Peppermint oil is commonly used to relieve toothache by soaking a cotton ball in the oil and placing it in the cavity or rubbing it directly on the affected tooth.[6,22,23]
- **Meswak (*Salvadora persica*):-** Meswak, derived from the Arak tree, is widely used in various cultures and many developing nations as a traditional toothbrush for maintaining oral hygiene. In recent years, Meswak extract has been incorporated into dentifrices due to its anti-plaque and antigingivitis properties.[6,22,23]
- **Garlic (*Allium sativum*):-** Garlic is one of the most extensively researched medicinal plants, known for its characteristic odour. Its antibacterial activity is attributed to allicin, which is produced by the enzymatic action of allinase (a cysteine sulfoxide lyase) when the garlic clove is crushed or cut. Garlic extract significantly inhibits the growth of *Streptococcus mutans* and can be an effective remedy for preventing dental caries, making it a valuable ingredient in toothpaste or mouthwash.[6,22,23]
- **Turmeric (*Curcuma longa*):-** Turmeric has been used in India for over 2,500 years. Historically, it has been valued for its antiseptic, antibacterial, anti-inflammatory, pain-relieving, and hepatoprotective properties. Applying a mixture of burnt turmeric powder and Bishop's weed seed on the teeth and gums strengthens them. Additionally, massaging aching teeth with roasted, ground turmeric can help eliminate pain and reduce swelling.[6,22,23]
- **Coconut (*Cocos nucifera*):-** Coconut products have long been revered in Indian folk medicine, with a history of use spanning thousands of years. They are believed to possess anti-blenorrhagic, anti-bronchitis, febrifugal, and anti-gingivitic properties. Coconut flour has antimicrobial properties, attributed to its high lauric acid content, and has been used as a remedy for oral infections, such as mouth sores.[6,22,23]

Piper betel Linn

Piper betle L. (also known as *Piper betel Blanco*) is a well-known perennial creeping plant from the Piperaceae family. It originates from central and eastern Peninsular Malaysia and has spread to East Africa and tropical regions of Asia[7]. The Piper betel plant, which belongs to the Piperaceae family, has deep green, heart-shaped leaves. The Piperaceae family itself includes over 2,000 species[8]. The leaves are nutritious and contain anti-carcinogenic properties, making them a promising candidate in the treatment of Blood cancer[9]. Betel leaf has traditionally been used to treat a variety of ailments, including bad breath, boils and abscesses, conjunctivitis, constipation, memory and learning issues, headaches, itching, mastitis, mastoiditis, leucorrhoea, ear discharge, as an antiseptic, for swollen gums, rheumatism, and for cuts and injuries[9]. Scientists have discovered that this plant exhibits several beneficial bioactivities, such as antimutagenic, anticarcinogenic, anti-inflammatory, antimicrobial, antioxidant, and antidiabetic properties[10]. After meals, *Piper betel L.* is frequently used for refreshment[11]. Betel leaves are used in a variety of ways in the Indian medical and health systems[11]. In Indian folk medicine, betel leaf is commonly used for its antibacterial properties and is applied topically to wounds and lesions to promote healing[11]. Betel leaf essential oil can be used as a raw material in the production of various products, including pharmaceuticals, fragrances, mouthwashes, tonics, and food additives[11]. It also includes antioxidant, anti-inflammatory, gastroprotective, hepatoprotective, cardioprotective, radioprotective, anticancer, antidiabetic, and analgesic properties[11]. 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[12]. The plant features alternate,

heart-shaped leaves that are smooth, shiny, and on long stalks, with a pointed tip[13]. The leaves have five to seven ribs originating from the base, and the plant produces minute flowers[13]. Betel is native to central and eastern Malaysia. It spread throughout tropical Asia at an early date and later reached Madagascar and East Africa[13]. In India, betel is extensively cultivated in Tamil Nadu, Madhya Pradesh, West Bengal, Odisha, Maharashtra, and Uttar Pradesh[13].

Plant Profile

The scientific classification and botanical name of *Piper betel Linn* (Golden Heart), are as follows:-

Table: - 1 Plant profile.[31]

Kingdom	Plantea
Division	Magnoliphyta
Class	Magnolipsida
Family	Piperaceae
Genus	Piper
Species	betel
Scientific Name	*Piper betel Linn.*(Betel vine).

Fig. 1. Piper betel Linn.

Types of Betel leaf

- **Red Betel leaf**:- Red betel (*Piper crocatum*) is highly sought after for its medicinal and ornamental qualities. Its attractive appearance, especially the striking red leaves, contributes to its high market value. The red betel plant is a climbing variety that grows on fences and trees. When exposed to light, the surface of the red betel leaf appears silvery red and reflective[13]. Refer to fig:-2.
- **Green Betel leaf:**- Green betel is commonly used for traditional rituals and medicinal purposes[13]. Refer to fig:- 3.
- **Golden Betel leaf**:- Golden betel, also known as betel jalu, is characterized by its batik-like or pale-yellow patches[13]. Refer to fig:- 4.
- **Black Betel leaf**:- Black betel is occasionally linked to supernatural beliefs and practices[13]. Refer to fig:- 5.

Fig:- 2 Red Betel

Fig:- 3 Green Betel

Fig:- 4 Golden Betel

Fig:- 5 Black Betel

Other Common Names

The other common names used for Betel leaf are as follows:-

- Sanskrit: Tambool, Mukhbhushan, Nagavalli, Varnalata, Nagavallari [7,29,30]
- Hindi, Bengali, Urdu: Paan[7,29,30]
- Telugu: Nagballi, Tamalapaku [7,29,30]
- Tamil: Vetrilai [7,29,30]
- Gujarati: Nagarbael[7,29,30]
- Marathi: Vidyache pan[7,29,30]
- Malayalam: Vettilakkoti, Vettila[7,29,30]
- Kannada: Veeleya, Veeleyada yele, Vilya, Villayadel [7,29,30]
- Konkani: Phodi paan[7,29,30]

In Other Asian languages:-

- English: Betle, Betle pepper, Betle vine [7,29,30]
- Vietnamese: Trầu [7,29,30]
- Thai: Plue, Pelu [7,29,30]
- Persian: Burg-e-Tanbol[7,29,30]
- Arabic: Tanbol [7,29,30]
- Sakai: Jerak [7,29,30]
- Semang: Seresa, Be, Cabe[7,29,30]
- Sinhalese: Bulath Jakun: Kerekap, Kenayek[7,29,30]
- Malay: Daun sirih, Sirih hudang, Sirih Carang, Sirih melayu[7,29,30]
- Kapampangan: Bulung samat[7,29,30]

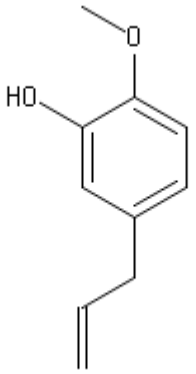
Chemical Composition

Betel leaf (*Piper betle L.*) contains a notable amount of essential oil, approximately 2.0% on a dry basis, in its juicy leaves[14]. The essential oil of betel leaf (Tamluk Mitha variety) primarily contains estragole, chavicol, chavibetol, β-cubebene, and caryophyllene[14,35]. Additionally, trace amounts of other components such as eucalyptol, α-cubebene, β-elemene, γ-muurolene, elixene, δ-cadinene, and 4-allylphenyl acetate are also present.[14,35].

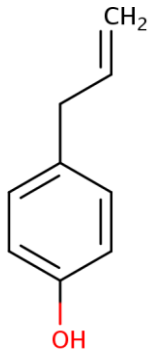
Table:-2 Chemical constituents[31,36]

Sr.no	Chemical constituents	Bioactive constituents
1.	Phenolic compounds	Chavicol, Hydroxychavicol, Chavibetol, Chavibetol Acetate and Eugenol
2.	Ethanolic compounds	Steroids, Diterpenes, Tannin, Cardial Glycosides, Flavonoids, Saponin, Phenols, Coumarin and Alkaloids
3.	Methanolic compounds	Steroids, Diterpenes, Tannin, and Saponin
4.	Butanoic compounds	Steroids, Diterpenes, Tannin, Flavonoids, Emodins and Alkaloids
5.	Acetone compound	Steroids, Diterpenes, Tannin, Flavonoids, Saponin and Coumarin
6.	Aqueous compounds	Steroids, Diterpenes, Tannin, Cardial Glycosides, Flavonoids, Saponin, Phenols, Coumarin and Alkaloids

Additionally, the leaves contain bitter compounds ranging from 0.7-2.6%, and their distinctive pungent aromatic flavor is attributed to phenolic and terpenoid compounds.



Chavibetol



Chavicol

Betel leaf contains specific chemicals such as Piperbetol, Methylpiperbetol, Piperol A, and Piperol B.[14]. Additionally, phenylpropanoids, cinnamoyl compounds, and six flavonoid derivatives have been reported in both aqueous and ethanolic extracts of the leaf.[14]. The leaves contain 3-3.5% protein, 0.5-6.1% carbohydrates, 2.3-3.3% minerals, and 0.1-1.3% tannins. They are also rich in essential nutrients like calcium, phosphorus, iron, iodine, potassium, and vitamins B, C, and A.[21]

Morphological Characters

The leaves have an aromatic and pungent flavor with a characteristic pleasant odour. Fresh leaves are green to dark green in colour[12]. These morphological features, including the presence of foreign organic matter, odour, size, colour, and shape, are detailed in following Table [12]:-

Table:- 3 Morphological description of Piper betel.

Sr.no	Characters	Description
1.	Dimensions	Length of leaf: 8-16cm Width: 6-12cm
2.	Taste	Aromatic
3.	Odour	Characteristic and pleasant
4.	Colour	Red,Green,Golden,Black

Benefits of Betel leaves in Oral health

Betel leaf, commonly used in various cultural practices, has several potential benefits for oral health due to its medicinal properties. Here are some of its uses:

- **Antimicrobial Properties**: Betel leaf has natural antimicrobial properties, which can help reduce harmful bacteria in the mouth, lowering the risk of infections like dental caries and gum disease.
- **Freshens Breath:** Chewing betel leaf is believed to freshen breath due to its strong aromatic properties. It can neutralize bad odors and help maintain a clean oral environment.
- **Strengthens Gums**: Betel leaf contains compounds that can strengthen gums, potentially reducing the risk of gum diseases like gingivitis and periodontitis.
- **Pain Relief**: The leaf has mild analgesic properties, which can provide relief from oral pain, including toothaches and mouth sores.
- **Anti-inflammatory Effects**: Betel leaf has anti-inflammatory properties that can help reduce inflammation in the mouth, aiding in the healing of oral ulcers and other inflammatory conditions.
- **Maintains Oral pH:** Chewing betel leaf may help maintain a balanced oral pH, which is crucial for preventing bacterial overgrowth and maintaining overall oral health.
- **Traditional Use in Ayurveda**: In Ayurvedic medicine, betel leaf is used as a mouthwash and in other oral care practices to prevent cavities, reduce plaque, and strengthen teeth.

Traditional Uses of Piper Betel

Here are some traditional uses and benefits of Piper betel leaves:

1. **Filariasis Treatment:** A paste made from Piper betel leaves mixed with salt and warm water (not too hot) can be used to treat filariasis.[12]
2. **Obesity Management:** Piper betel leaves, when combined with Piper nigrum and used for two months, may help in curing obesity[12]
3. **Cough, Dyspnea, and Indigestion:** The juice of betel leaves mixed with honey is used to treat coughs, shortness of breath, and indigestion, especially in children[12]
4. **Lactation Aid:** Betel leaves are believed to promote milk secretion in lactating women. Applying leaves smeared with oil on the breasts can enhance this effect.[12]
5. Betel leaf also possesses a wide range of therapeutic properties, including anticancer, anti-amoebic, antigiardial, anti-inflammatory, mosquito larvicidal, antimicrobial, immunomodulatory, antiulcerogenic, radioprotective, antileishmanial, and antifungal activities.[19]
6. Betel leaf is used in the treatment and control of filarial infections, obesity, skin diseases, and conjunctivitis.[20]
7. **Scanty or Obstructed Urination:** Betel leaf juice has diuretic properties. When mixed with diluted milk and slightly sweetened, it helps ease the passage of urine.[20,21,33]
8. **Weakness of Nerves:** Betel leaves are beneficial in treating nervous disorders. The juice from a few betel leaves, combined with a teaspoon of honey, serves as a good tonic. A teaspoon of this mixture can be taken twice a day.[20,21,33]
9. **Headaches:** Betel leaf has analgesic and cooling properties. It can be applied to the forehead to relieve intense headache.[20,21,33,34]

10. **Respiratory disorders:** Betel leaves are useful in treating pulmonary issues, particularly in children and the elderly. Soaked in mustard oil and warmed, the leaves can be applied to the chest to relieve coughs or difficulty in breathing.[20,21,33]
11. **Gastroprotective:** Allylpyrocatechol has gastroprotective properties by reducing damaging factors such as reactive oxygen species (ROS) and lipid peroxidation. It also enhances protective factors, increasing antioxidant levels and mucus production, which help shield the stomach lining from damage.[21,24,33]
12. **Hepatoprotective:** Allylpyrocatechol protects the liver by reducing the production of reactive oxygen species (ROS) by Kupffer cells and the enzyme CYP2E1. It also increases antioxidant levels, further aiding in liver protection.[24,32,33]

Different Formulations of Betel leaf

Sr. no	Formulations available
1.	Polyherbal antibacterial cream[15]
2.	Lotion preparation of Betel leaf[16]
3.	Antibacterial agent in solid soap formulation[17]
4.	Antifungal herbal gel using aloevera and betel leaf[18]

Marketed Formulations

Sr.no	Formulation	Brand name	Marketed products available
1.	Betel leaf toothpaste	Bentodent	
2.	Betel leaf essential oil	VedaOils	
3.	Betel leaf chocolate	thebetelleaf	
4.	Betel leaf powder	Herbal magic	
5.	Betel leaf juice	Gulabs	

6.	Betel & Curry Leaves Hair Shampoo	Beauty Bee	
7.	Betel leaf roll on	Malar	

Conclusion

From the above collected data, it clearly proves that Betel Leaf *(Piper betel L*) is a highly beneficial herb with a range of applications. As mentioned earlier, Betel leaf exhibits anticancer, anti-microbial, anti-inflammatory, cholinomimetic, and antifungal activities. It is also used to treat bad breath, conjunctivitis, constipation, itching, and headaches. Historically, Betel leaf has been employed for treating gum swelling, abrasions, cuts, and rheumatism. Thus, it can be concluded that the leaves of *Piper betle*, particularly the Golden Heart variety, hold significant potential as a novel source for various therapeutic applications.

References

1. Urse GN. “Systemic disease manifestations in the oral cavity”. Osteopathic Family Physician. 2014 May 5;6(3).
2. Shahare N, Chouhan S, Darwhekar GN. “Herbs used in treatment of mouth ulcer-a review”. International Journal of Pharmacognosy and Chemistry. 2021 Jul 29:68-74.
3. de Almeida e Bueno L, Kwong MT, Bergmann JH.“Performance of Oral Cavity Sensors: A Systematic Review”. Sensors. 2023 Jan 4;23(2):588.
4. Mosca AC, Chen J. “Food-saliva interactions: Mechanisms and implications”. Trends in Food Science & Technology. 2017 Aug 1;66:125-34.
5. Brodsky L. “Structure and development of the upper respiratory system in infants and children.” InPediatric Critical Care 2011 Jan 1 (pp. 485-489). Mosby.
6. Dhaliwal JS, Gambhir RS, Sodhi SK, Shaheed G, Binti DK, HajiPG KM. “Herbs and their use in oral care: A Review”. Brunei Darussalam Journal of Health. 2017;7(1):5-17.
7. Biswas P, Anand U, Saha SC, Kant N, Mishra T, Masih H, Bar A, Pandey DK, Jha NK, Majumder M, Das N. Betelvine (Piper betle L.): “A comprehensive insight into its ethnopharmacology, phytochemistry, and pharmacological, biomedical and therapeutic attributes”. Journal of Cellular and Molecular Medicine. 2022 Jun;26(11):3083-119.
8. “An Review: On Nutritive Activity and Ayurvedic Property of Piper Betel(Paan)”. 1Sankpal Pooja Mansing; 2Ratnaparkhi Pranali Prashant Pharmaceutical Chemistry Department, Late. Adv Dadasaheb Chavan Memorial Institute of Pharmacy Malwadi Masur, Karad. IJISRT24MAY527.
9. “Traditional Use and Pharmacological Activity of Betel Leaf (Piper betle Linn.)”. P.DIVYA et al. Ijppr..Human, 2021; Vol. 21 (3): 640-650.
10. Jandu R, Kaur L. “A review: Nutritional and nutraceuticals properties of betel leaves (Piper betle L.)”. Global Journal of Engineering and Technology Advances.
11. Panda N, Panda A. “Piper betel-Not Just a Mouth Freshener But Also a Miraculous Herb for Healing: A Review”. Asian Journal of Biology. 2023 May 10;18(2):20-33.
12. Afridi M, Muhammad IM, Ahmad T, Hussain A, Akram M, Ghotekar S, Oza R, Marasini BP. “Ethno-medicinal uses of Piper betel—A review”. Adv. J. Chem.-Sect. B. 2021;3:199-208.
13. Kirve DC. “An overview of betel leaf: Green gold of India”. Journal of Pharmacognosy and Phytochemistry. 2024;13(2):240-8.

14. Roy A, Guha P. “Traditional and functional uses of betel leaf (Piper betle L.) pertaining to food sector: a review”. J Postharvest Technol. 2021 Jan;9(1):72-85.
15. Mulla M, Shinde S, Chougule N. “Formulation and evaluation of polyherbal antibacterial cream by using Tulsi, betel leaf and liquorice extract.”
16. Hadning I, Kurnyaningtyas P, Ghozali MT. “The formulation of lotion preparations of betel leaf extract (Piper betle)”. Journal of Fundamental and Applied Pharmaceutical Science. 2020 Aug;1(1):29.
17. Wulandari R, Nugraheni IK, Kiptiah M. “Betel leaf extract as an anti-bacterial agent in solid soap formulation and characterization”. Jurnal Pijar Mipa. 2023 May 31;18(3):436-41
18. Bahekar SD, Mujariya RZ, Singh M. “Formulation and evaluation of antifungal herbal gel using Aloe Vera and Betel leaves extract for the treatment of candidiasis”. World Journal of Biology Pharmacy and Health Sciences. 2024;18(2):309-17.
19. Suri MA, Azizah Z, Asra R. “A review: Traditional use, phytochemical and pharmacological review of red betel leaves (Piper crocatum Ruiz & Pav)”. Asian Journal of Pharmaceutical Research and Development. 2021 Feb 15;9(1):159-63.
20. Ahuja SC, Ahuja U. “Betel leaf and betel nut in India: History and use”s. Asian Agri-History. 2011 Jan 1;15(1):13-35.
21. Rai KK, Trivedi RV, Umekar MJ. “Review on betel leaf used in various ailments”. Int J Pharmacognosy. 2019;6(8):259-67.
22. Rajagopalan A. “Herbal products in oral hygiene maintenance–a review”. IOSR Journal of Pharmacy. 2015;5(1):48-51.
23. Anushri M, Yashoda R, Puranik MP. “Herbs: A good alternatives to current treatments for oral health problems. Dermatitis”. 2015;7:9-12.
24. Haslan H, Suhaimi FH, Thent ZC, Das S. “The underlying mechanism of action for various medicinal properties of Piper betle (betel”). Clin Ter. 2015 Sep 1;166(5):208-14.
25. Circu ML, Aw TY. “Reactive oxygen species, cellular redox systems, and apoptosis”. Free radical biology and medicine. 2010 Mar 15;48(6):749-62.
26. Ganguly S, Mula S, Chattopadhyay S, Chatterjee M. “An ethanol extract of Piper betle Linn. mediates its anti-inflammatory activity via down-regulation of nitric oxide”. Journal of Pharmacy and Pharmacology. 2007 May;59(5):711-8.
27. Guha P. “Betel leaf: the neglected green gold of India. Journal of Human Ecology”. 2006 Feb 1;19(2):87-93.
28. Gundala SR, Yang C, Mukkavilli R, Paranjpe R, Brahmbhatt M, Pannu V, Cheng A, Reid MD, Aneja R. Hydroxychavicol, “a betel leaf component, inhibits prostate cancer through ROS-driven DNA damage and apoptosis”. Toxicology and applied pharmacology. 2014 Oct 1;280(1):86-96.
29. Pradhan D, Suri KA, Pradhan DK, Biswasroy P. “Golden heart of the nature: Piper betle L”. Journal of Pharmacognosy and Phytochemistry. 2013;1(6):147-67.
30. Balkrishna A. “Secrets of Indian herbs for good health”. Divya prakashan, Uttarakhanda. 2008;32.
31. Azahar NI, Mokhtar NM, Arifin MA. “Piper betle: a review on its bioactive compounds, pharmacological properties, and extraction process”. InIOP Conference Series: Materials Science and Engineering 2020 Dec 1 (Vol. 991, No. 1, p. 012044). IOP Publishing.
32. Kumar S, Juyal A, Bisht S, Jaiswal V. “Betel leaf (Piper betle): Ethnomedicine to emerging therapeutic frontiers”. Journal of Pharmacognosy and Phytochemistry. 2024;13(2):249-58.
33. Tanajee Sunil More, Dr. Prachi Udapukar, Madane N.N. “Betel leaf used in Cough syrup”. International Journal of creative research thoughts. Volume 11, Issue 5 May 2023.
34. Sankpal Pooja Mansing, Ratnaparkhi Pranali Prashant. “An Review: On Nutritive Activity and Ayurvedic Property of Piper Betel(Paan)”. Volume 9, Issue 5, May – 2024. https://doi.org/10.38124/ijisrt/IJISRT24MAY527.

35. Vikash C, Shalini T, Verma NK, Singh DP, Chaudhary SK, Asha R. “Piper betel Phytochemistry, traditional use & pharmacological activity a review”. International Journal of Pharmaceutical Research and Development (IJPRD). 2012;4(4):216-23.