Phytochemistry and therapeutic activities of *Piper betel* Linn. Leaves

Eanguwar Srinivas Reddy, Shivraj Kashinath Bembrekar, Rameshwar Ramchandra Bichewar and Datta Waghamode

Abstract

The present paper deals with an extensive review on the phytochemical and therapeutic activities of *Piper betel* leaves. It is known as a rich source of alkaloids, tannins, saponins, flavanoids and polyphenols respectively. The innumerable medicinal properties and therapeutic uses of *Piper betel* as well as its phytochemical investigations prove its importance as a valuable medicinal plant.

Keywords: Phytochemistry, therapeutic activities and *Piper betel*

Introduction

Medicinal herbs are moving from fringe to mainstream use with a greater number of people seeking remedies and health approaches free from side effects caused by synthetic chemicals. India officially recognizes over 3000 plants for their medicinal value. It is generally estimated that over 6000 plants in India are in use in traditional, folk and herbal medicine, over the last few years, researchers have aimed at identifying and validating plant-derived substances for the treatment of various diseases. Interestingly it is estimated that more than 25% of the modern medicines are directly or indirectly derived from plants. It is worth mentioning that Indian medicinal plants are considered as a vast source of several pharmacologically principles and compounds that are commonly used as home remedies against multiple ailments [1]. Since early 1990s, the use of forest products for medicine has been emerging as a vital income generating resource for the development of various social groups, hence, there is an increased attention for their long-term sustainability [2]. Indian traditional medicine is based on various systems including Ayurveda, Siddha, Unani and Homoeopathy. The evaluation of these drugs is primarily based on phytochemical, pharmacological and allied approaches including various instrumental techniques such chromatography, microscopy and others. With the emerging worldwide interest in adopting and studying traditional systems and exploiting their potential based on different health care systems, the evaluation of the rich heritage of traditional medicine is essential [3]. In this regard, one such plant is *Piper betel* [4].

There are about 100 varieties of betel vine in the world, of which about 40 are found in India. *Piper betle* (Local name ‘Paan’) Piperaceae, a dioecious, annual creeper, climbing by many small adventitious rootless, grows to a height of about one meter, generally grown in hotter and damper parts of the country [5, 6]. It is extensively found in damp forests and is propagated in India and other countries in South-East Asia, such as Vietnam and China. In India it is found in Uttar Pradesh, Bihar, Bengal, Orissa, Tamilnadu, Andhra Pradesh and Karnataka. In Tamilnadu, three varieties of *Piper betle* leaves, Sirugamani, Karpoori and Vellaikodi are accessible mostly [7]. It is used in variety of decoction, in curing wounds, burns, impetigo, furuneloris, eczema, lymphangitis and juice is beneficial stomachic. Kammaru (a variety of *Piper betle*) leaf has a good level of juice that heals pharyngitis, abdominal pain and swelling. Generally betle leaf cures urticaria and as per ayurvedic medicine, it recovers the loss of equilibrium between the three ‘humours,’ namely, Vatha, Pitha and Kapha. The roots and fruits are well-known for treatment of malaria, asthma [8, 9]. The chief Ayurvedic preparations of *Piper betle* plant are Lokantha Rasa, Puspadhara Rasa, Brhat sarwajwaraahara, lanha, laghu sutaseknara Rasa, Brhat visamaj warantaka Rasa. In Ayurveda, betle leaf juice is commonly utilized as an adjuvant & combined with different other medicines most likely for better effects beside its separate use as medicine. In Susra-Samhita, tambool leaves have been described as aromatic, sharp, hot, acrid and valuable for voice, laxative, appetizer, beside this they soothe vata and aggravate pitta [10].
According to folk medicine, betel leaf can help in the treatment of headache, itching, mastitis, cuts, abrasions, constipation, and injuries \[11, 12\].

**Phytochemical review**

*Piper betle* leaf extract contains phytosterols, alkaloids, carbohydrates, water, tannins, phenols, flavonoids, and essential oils. Oils from the leaves contain carvacrol, eugenol, safrole, allylpyrocatechol monooacetate, eugenol, eugenyl acetate, hydroxychavicol, eugenol, piPER betol and the betle oil contains cadinene, carvacrol, allyl catechol, chavicol, p-cymene, carvophyllene, chavibetol, cineole, estragol, etc. as the key components \[15\]. Phytochemical analysis on leaves revealed the presence of Alkaloids, Tannins, Carbohydrate, Amino acids and Steroidal components. The chief component of the leaves is a volatile oil in the leaves from different countries, called Betle oil and contains 2 phenols, betle phenol (Chavibetol and Chavicol). Codinene has also been found \[10\]. Chavibetol is a natural chemical compound of the phenylpropanoid class. It is the most important component of the essential oil from the leaves of the *Piper betle* plant. It is an aromatic compound with a spicy odor and is an isomer of eugenol \[17, 18\]. The therapeutic activities are reported with plant part extract, activity methods and results are depicted in Table No. 1.

**Therapeutic activities**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Plant part/Extract</th>
<th>Activity/Animal/ Model</th>
<th>Results</th>
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<tbody>
<tr>
<td>1</td>
<td>Aqueous extract of the fresh <em>Piper betle</em> leaves.</td>
<td>Anti-microbial activity/ Various microorganisms/disc diffusion method.</td>
<td>Aqueous extracts showed effective inhibitory action against the microorganisms [19].</td>
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<td>2</td>
<td><em>Piper betle</em> leaves/hot water extract/cold ethanolic extract.</td>
<td>Antioxidant activity/Initial anti-oxidant activity, Antioxidant activity with time (at elevated temperature (200 °C)).</td>
<td>The extracts obtained from the leaves of <em>Piper betle</em> had profound antioxidant activity [20].</td>
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<td>3</td>
<td><em>Piper betle</em> spray dried powder.</td>
<td>Antidiabetic activity/diabetes mellitus patients.</td>
<td><em>Piper betle</em> as an utraceutical resulted as a potential treatment for type 2 diabetes patients [21].</td>
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<td>4</td>
<td>Aqueous extract of the fresh <em>Piper betle</em> leaves.</td>
<td>Anti-oxidative &amp; anti-hemolytic activity/Microorganisms (Streptococcus pyogenes, Staphylococcus aureus, Pseudomonas aeruginosa &amp; Escherichia coli).</td>
<td>The anti-oxidative &amp; anti-hemolytic activities were attributed to the high concentration &amp; combined activity of flavonoids &amp; polyphenols [22].</td>
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<td>5</td>
<td>Crude ethanolic extracts of <em>Piper betle</em> leaves.</td>
<td>Anti Dermato phytic activity/ zoonotic dermatophytes (M. canis, M. gypseum, and T. mentagrophytes) and yeast-like Candida albicans.</td>
<td>Testing showed <em>Piper betle</em> cream formulation with potential therapeutic values for treatment of Dermato phytases [23].</td>
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<td>6</td>
<td>Testing showed <em>Piper betle</em> cream formulation with potential therapeutic values for treatment of Dermatophytosis.</td>
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<td>The study reveals that both the aqueous and alcoholic extracts be active beside the strains of bacteria which are common cause of infections [24].</td>
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<td>7</td>
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<td>8</td>
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<td>Field tests in a corn field using trap contain the extracts, which does not detect adult moths of <em>Ostrinia alentalis</em> [26].</td>
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<td>9</td>
<td>The methanolic extract of the <em>Piper betle</em> leaves.</td>
<td>Analgesic and anti-inflammatory activity/Carragen an induced hind paw edema model, hot plate, writhing and formalin tests/ Swiss albino mice and Wistar Rats.</td>
<td>The dose produced a significant increase in pain threshold in hotplate method whereas significantly reduced the writhing caused by acetic acid &amp; caused significant inhibition of carrageen an induced paw edema [27].</td>
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<td>10</td>
<td>The <em>Piper betle</em> plant extract.</td>
<td>Anti-fertility activity/ female rats.</td>
<td>The data suggests that betle extract brought about anti-fertility and antistrogenic effects in female rats [28].</td>
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<td>11</td>
<td>The <em>Piper betle</em> leaf extract.</td>
<td>Anti-hepatotoxic effect/ ethanol &amp; carbon tetrachloride (CCl4) induced liver injury in a rat model.</td>
<td>The histological examination shows that <em>Piper betle</em> leaf extract secluded liver from the damage induce by CCl4 by declining alpha smooth muscle act in (alpha-sma) expression [29].</td>
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<td>12</td>
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<td>Skin Antiseptic/ pre-surgery cataract patients.</td>
<td>Results showed that 20% <em>Piper betle</em> leaf infusion to have an anti-septic [30].</td>
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<td>13</td>
<td>The ethanolic extract of <em>Piper betle</em> leaf.</td>
<td>Radio protective activity/ Rat liver mitochondria and pBR 322 plasmid DNA.</td>
<td>The extract of <em>Piper betle</em> effectively prevented γ-ray induced lipid Peroxidation [31].</td>
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<td>14</td>
<td>The methanolic extract of the <em>Piper betle</em>.</td>
<td>Immuno modulatory activity/ Mice.</td>
<td>The study reveals that it significantly suppressed hemaglutinin stimulated Peripheral blood lymphocyte proliferation in a dose-dependent manner [32].</td>
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<tr>
<td>15</td>
<td>The ethanolic Extract of <em>Piper betle</em> leaves.</td>
<td>Anti-depressant Activity/ Mice.</td>
<td>The study showed that it has significant anti-depressant activity greater than Imipramine and has the potential to be used as an anti-depressant [33].</td>
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</tbody>
</table>
Conclusion
The medicinal importance of the betle leaf as evidently prove that is one of the most promising commercial botanical with earlier reported to possess a lot of therapeutic values. The leaf has the great potency to act as natural antioxidant. The anti-oxidant property is correlated with different biological activities like Antibacterial, Hepatoprotective, Antidiabetic, Antifertility, Antiseptic, Antidepressant and Anticancer properties, since free radicals are involved in all these diseases. The leaf extract also shows the Gastro protective activity by enhancing the mucus rather than decrease the acid production. Considering the above properties, it comes to conclusion that betle leaf has a tremendous strength to come out as a future green medicine.

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References
20. Daniel M. Useful herbs of planet earth; Betel, TAMBULAH/Pan (Piper betel Linn.-Piperaceae, Scientific publishers (India), Jodhpur; c2013. p. 255.