# Chapter 2: Literature Survey

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CHAPTER - 2

LITERATURE SURVEY

Laboratories around the world are engaged in the screening of plants for biological activity with therapeutic prospective. Keeping the above point in view, the following plants have been selected for a thorough investigation of pharmacognostic, phytochemical and pharmacological properties, a through literature survey has been carried out and documented as follows.

1. *Basella rubra* L. (Basellaceae)

2. *Phyllanthus acidus* L. (Phyllanthaceae)

2.1 DESCRIPTION OF *BASELLA RUBRA*.

**Vernacular Names:**

Hindi : Poi
Telugu : Alubachchali, Karu-bach-chali, Peddabach-chali
Sanskrit : Potaki, Upodika.
English : Malabar Nightshade

**Taxonomy of Basella rubra:**

Kingdom : Plantae
Division : Magnoliophyta
Class : Magnoliopsida
Subclass : Core eudicots
Order : Caryophyllales
Family : Basellaceae
Genus : Basega
Species : Basella rubra

**Botanic description**:

Habit : herb, vine
Important diagnostics : succulent
Taxon group : dicots
Stem : rhizome, tuberous

Leaf
Position : opposite, alternate
Nature : simple
Margin : entire

Flowers
Inflorescence : raceme, spike, panicle
Sexuality : bisexual, unisexual
Symmetry : actinomorphic
Perianth number : 5
Petal number : 5
Petal position : all free, connate
Bract : present
Bractlet : present

Stamen: Number : 4, 5, 6, 7, 8, 9
Arrangement : antepetalous
Filaments : inserted on the corolla
<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pistil: Style</td>
<td>styles more than 1</td>
</tr>
<tr>
<td>Carpel</td>
<td>3</td>
</tr>
<tr>
<td>Ovary</td>
<td>1-loculed</td>
</tr>
<tr>
<td>Ovule</td>
<td>1 per locule</td>
</tr>
<tr>
<td>Pistil</td>
<td>connate or basally connate</td>
</tr>
<tr>
<td>Ovary position</td>
<td>superior</td>
</tr>
<tr>
<td>Fruit: Types and characters</td>
<td>fleshy, utricle</td>
</tr>
<tr>
<td>Seed</td>
<td>1 seed</td>
</tr>
<tr>
<td>Endosperm</td>
<td>seeds with endosperm</td>
</tr>
</tbody>
</table>

Fig: 2.1. Exomorphic Features of the *Basella rubra*. 
2.2 PHARMACOLOGICAL REVIEW OF BASELLA RUBRA:

Bolognesi A\textsuperscript{32} et al., (1997) isolated new single-chain (type 1) ribosome-inactivating proteins (RIPs) were isolated from the seeds of *Basella rubra* and from the leaves of *Bougainvillea spectabilis*. These RIPs inhibit protein synthesis both in a cell-free system, with an IC\textsubscript{50} (concentration causing 50% inhibition) in the 10(-10) M variety, and by many cell lines, with IC\textsubscript{50}s in the 10(-8)-10(-6) M variety. All three RIPs liberated adenine not only from rat liver ribosomes but also from E. coli rRNA, polyadenylic acid, herring sperm DNA, and artichoke mottled crinkle virus (AMCV) genomic RNA, as a result being polynucleotide: adenosine glycosidases. The proteins from *Basella rubra* had noxiousness to mice similar to that of most type 1 RIPs with an LD\textsubscript{50} (concentration that is 50% lethal) < or = 8 mg.kg\textsuperscript{-1} body weight, whilst the RIP from *Bougainvillea spectabilis* had an LD\textsubscript{50} > 32 mg.kg\textsuperscript{-1}. The N-terminal sequence of the two RIPs from *Basella rubra* had 80-93% identity, whereas it differed from the sequence of the RIP from *Bougainvillea spectabilis*. When confirmed with antibodies against various RIPs, the RIPs from *Basella rubra* gave some cross-reactivity with sera against dianthin 32, and fragile cross-reactivity with momordin I and momorcochin-S, whereas the RIP from *Bougainvillea spectabilis* did not cross-react with any antiserum verified. An RIP from *Basella rubra* and one from *Bougainvillea spectabilis* were tested for antiviral activity and both withdrawn infection of Nicotiana benthamiana by AMCV.
2.3 CHEMICAL REVIEW OF *BASELLA RUBRA*:

**Murakami T**$^{33}$ *et al.*, (2010) isolated structures of new oleanane-type triterpene glycosides, basellasaponins A, B, C, and D, from the aerial parts of *Basella rubra*. Basellasaponins A, B, C, and D, oleanane-type triterpene glycosides having the dioxolane-type substituent, were isolated from the aerial parts of *Basella rubra* collected with spinacoside C, betavulgaroside I and momordins IIb and IIc. The structures of basellasaponins A, B, C, and D were confirmed. The isolated triterpenes were further recognized by Salkowski and Liebermann-burchard tests. The isolated triterpenes were of β-amyrin type. They were biosynthetically derived from acetate-mevalonate pathway.

**Dong CX**$^{34}$ *et al.*, (2012) isolated four neutral polysaccharides (BRN-1, BRN-2, BRN-3 and BRN-4) from the hot water extract of the aerial part of *Basella rubra*. They were found to comprise of a huge amount of D-galactose (81.0-92.4%) and small amounts of L-arabinose (5.4-7.8%), D-glucose (2.2-11.0%) and mannose (~2.9%). Linkage analysis revealed that all these neutral polysaccharides might be arabinogalactan type I polysaccharides in different molecular weight and chain length. Out of them, only BRN-3 exhibited antiviral activity against herpes simplex virus type 2 (HSV-2) with 50% inhibitory concentration of 55 μg/mL without showing the cytotoxicity up to 2300 μg/mL. Moreover, the antiviral target of BRN-3 was shown to be the inhibition of virus adsorption to host cells.
USES:

The plant has been known to be a demulcent, a diuretic and an emollient in action. The whole plant is used in Chinese medicine, where it is demanded to diminish fever and neutralize poison. A decoction of the leaves is said to have laxative properties, and is used in prenatal women and children to treat constipation. The extract mixed with *Hibiscus rosasinensis* is given to pregnant women as a harmless aperients. The juice of the plant is used as a colorant for official stamps, as a rouge on the facial skin and food colouring\(^{35}\). In southern India, the plant is used for the treatment of Aphthae\(^ {36}\). The leaves of *Basella rubra* contain flavonoids and exhibit antioxidative, antiproliferative properties and are used in catarrhal affection. The extracts were found to exhibit numerous beneficial effects such as chemo and central nervous system protection and anticancer activities\(^ {37}\). They are used as anthelmentic, demulcent, hepatoprotective, antidiabetic, anti-inflammatory and analgesics.

2.4 DESCRIPTION OF *PHYLLANTHUS ACIDUS*\(^ {38}\)

Vernacular names:

<table>
<thead>
<tr>
<th>Language</th>
<th>Vernacular Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindi</td>
<td>Chalmeri, Harparaauri, Harpharevadi</td>
</tr>
<tr>
<td>Telugu</td>
<td>Raacha usiri</td>
</tr>
<tr>
<td>Sanskrit</td>
<td>Lavaliphala</td>
</tr>
<tr>
<td>English</td>
<td>country gooseberry, Malay gooseberry</td>
</tr>
</tbody>
</table>

Taxonomy of *Phyllanthus acidus*:

<table>
<thead>
<tr>
<th>Rank</th>
<th>Taxon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingdom</td>
<td>Plantae</td>
</tr>
<tr>
<td>Division</td>
<td>Magnoliophyta</td>
</tr>
</tbody>
</table>
Class : Magnoliopsida  
Order : Magnoliales  
Family : Phyllanthaceae  
Genus : Phyllanthus  
Species : Phyllanthus acidus  

**Botanical description**:  

Leaves : pinnate, 20-40 cm long.  
Leaflets : alternate, simple, entire, and shortly petiolate.  
Base : obtuse to rounded,  
Apex : acute, petiole 2.5-4 mm long.  
Stipules : triangular-acuminate.  
Flowers : slight, pink, in dense, cushion-cymules.  
Male : 4-merous, filaments and anthers free.  
Female : 4-merous, disk deeply lobed,  
Styles : connate, deeply bifid, superior ovary.
2.5 PHARMACOLOGICAL REVIEW OF PHYLLANTHUS ACIDUS:

Little work has been done on the leaves of *Phyllanthus acidus*. Pharmacological activities studied until now are given below.

Lee CY\(^{39}\) et al., (2006) evaluated hepatoprotective activity in CCl\(_4\) - induced liver injury in albino rats using essential biochemical parameters. The effect of oral administration of Phyllanthus methanolic extracts (PME) (i.e. *P. acidus*, *P. emblica*, *P. multiflorus*, *P. amarus*, *P. myrtifolius*, *P. embergeri*, *P. debilis*, *P. hookeri*, *P. urinaria* L.s. nudicarpus, *P. tenellus*, *P. urinaria* L.s. urinaria) or gallic acid on the progression of acute liver damage induced by CCl\(_4\) in rats was examined by morphological and biochemical means. *P. urinaria* L.s. urinaria, *P.
acidus, gallic acid at a dose of 0.5 g/kg, and *P. urinaria* L.s. nudicarpus, *P. emblica* at a dose of 1.0 g/kg reduced CCl₄-induced increase in serum glutamate-oxalate-transaminase (GOT). *P. acidus*, *P. urinaria* L.s. nudicarpus, *P. urinaria* L.s. urinaria, gallic acid at a dose of 0.5 g/kg, and *P. amarus*, *P. emblica*, *P. tenellus* and *P. hookeri* at a dose of 1.0 g/kg reduced CCl₄-induced increase in serum glutamate-pyruvate-transaminase (GPT). Concurrently, *P. acidus*, *P. embergeri*, *P. multiflorus*, *P. tenellus*, *P. hookeri* and *P. urinaria* L.s. urinaria raised the activity of liver reduced glutathione peroxidase. Since the protective effects of *P. emblica*, *P. acidus*, *P. embergeri*, *P. myrtifolius*, *P. urinaria* L.s. urinaria, *P. urinaria* L.s. nudicarpus and gallic acid compare with a reduction in liver infiltration and focal necrosis observed using anatomical methods, these statistics reveal that *P. urinaria* L.s. urinaria and *P. acidus* are hepatoprotective and antioxidant agents.

Sousa M⁴⁰ *et al.*, (2007) reported an extract from *Phyllanthus acidus* and its isolated compounds were used in the treatment for cystic fibrosis. Traditional medicinal plants from China and Thailand contain phytoflavonoids and other bioactive compounds. *Phyllanthus acidus* extract was examined for their potential effects on epithelial passage. Functional tests by Ussing chamber, double-electrode voltage-clamp and Ca²⁺ imaging demonstrate activation of Cl⁻ secretion and inhibition of Na⁺ absorption by *P. acidus*. Not any cytotoxic effects of *P. acidus* could be perceived. Mucosal application of *P. acidus* to native mouse trachea
proposed transient and steady-state activation of Cl⁻ secretion by increasing both intracellular Ca²⁺ and cAMP. These effects were mimicked by a mix of the isolated constituents adenosine, hypogallic acid and kaempferol. Additional trials in human airway cells and CF transmembrane conductance regulator (CFTR)-expressing BHK cells and Xenopus laevis oocytes confirm the results obtained in native tissues. P. acidus corrects defective electrolyte transport in CF airways by parallel mechanisms including 1) increasing the intracellular levels of second messengers cAMP and Ca²⁺, thus stimulating Ca²⁺-dependent Cl⁻ channels and residual CFTR-Cl⁻ conductance; 2) stimulating basolateral K⁺ channels; 3) redistributing cellular localization of CFTR; 4) directly activating CFTR; and 5) inhibiting ENaC through stimulation of CFTR. These combinatorial effects on epithelial transport may provide a novel complementary nutraceutical treatment for the CF lung disease.

**Supratik Kundu** et al., (2009) reported Immunomodulatory effects of *Phyllanthus acidus* and *Parkia javanica* whole plant extracts on murine splenic macrophages.

**Yuttapong Leeya** et al., (2010) evaluated hypotensive activity of an n-butanol extract from leaves of *Phyllanthus acidus* (PA extract). PA extract caused a reduction in blood pressure of anesthetized rats that was not modified by atropine or propranolol. PA extract produced a firm dilatation of thoracic aortic rings preconstricted with either phenylephrine, and these effects were not revised by LNA or removal of
vascular endothelial cells. On behalf of phenylephrine-preconstricted aortic rings, the dilatory action of the PA extract was not modified by atropine, propranolol or indomethacin. TEA, glibenclamide or ODQ significantly inhibited the dilatory activity of the PA extract on endothelium-denuded aortic rings. Nifedipine depressed the aortic rings constrictor response to phenylephrine, and that was further increased by the PA extract. 4-hydroxybenzoic acid, adenosine, caffeic acid, kaempferol and hypogallic acid were isolated from the PA extract. Everyone caused a reduction in blood pressure and dilatation of the aortic rings. LNA or elimination of the endothelium decreased this activity. ODQ and TEA reduced the vasodilatory activity of adenosine whereas glibenclamide and ODQ attenuated the effect of hypogallic acid. These results propose that the hypotensive activities of the PA extract is likely the result of the direct action of these five compounds on the blood vessels by stimulating release of nitric oxide from the vascular endothelial cells, in part through motivation of soluble guanylate cyclase, and opening of K\text{ATP} and K\text{Ca} channels in the vascular smooth muscle.

Raja Chakraborty\textsuperscript{43} \textit{et al.}, (2012) evaluated analgesic, anti-inflammatory, \textit{in vitro} antioxidant potential, total phenolic and total flavonoid content of methanolic extracts leaves of \textit{Phyllanthus acidus}. Analgesic activity of the extracts was estimated against acetic acid induced writhing, tail immersion method, formalin test. Anti-inflammatory activity was evaluated using carrageenan induced paw
oedema, cotton pellet induced granuloma and membrane stabilizing activity method. Free radical scavenging and antioxidant potential of the extracts of *Phyllanthus acidus* leaves was performed using several *in-vitro* and *ex-vivo* assay methods. Total phenolic and total flavonoid contents of the extracts were determined using standard chemical methods. The extracts showed substantial anti-inflammatory and analgesic activities at dose dependent manner. Methanolic extract at a dose of 500 mg/kg showed greater activity which was similar with the standard drugs. Ethyl acetate extract exhibited adequate activity while petroleum ether extract showed minimum activity. Total flavonoid and total phenolic content in methanol extract were 73.08 ± 0.682 mg GAE/g and 61.28 ± 0.062 mg QE/g respectively. The extracts have significant antioxidant activity, methanol extract exhibited utmost IC<sub>50</sub> value. Flavonoids and phenolic compounds could be associated with the analgesic, antioxidant and anti-inflammatory activities observed for *Phyllanthus acidus* leaves.

**USES:**

Exhaustive literature survey showed that the plant is a good remedy for different types of ailments like vomiting, constipation<sup>44</sup>, hypertension<sup>45</sup>, jaundice<sup>46</sup>, psoriasis<sup>47</sup>, diabetes<sup>48</sup>, algesia<sup>49</sup>, cough, asthma<sup>50</sup> and as rehabilitation<sup>51</sup>. And it is also used in urticaria, eruptions<sup>52</sup>, sciatica, rheumatism, gonorrhea and skin disorders<sup>53</sup>. *Phyllanthus acidus* is a small tree cultivated as a fruit tree in many countries. The plant parts are being used in Indian folk medicine and its
leaves were reported to be useful to treat fever, piles, small pox and blood vomiting\textsuperscript{54}. 