Ethno botanical and phytopharmacological recent review of Aegle marmelos medicinal values

Neeta Raghuveer and Bela Zutshi

Abstract
This review was undertaken to find out the ethnobotanical and phytopharmacological review of Aegle marmelos. Extensive information about the plant has been together from various books, journals and Ayurvedic classical texts, unpublished data, expected research etc. Researchers, pharmacologists and Ayurveda treatment possibly determine and help the security of plant. Aegle marmelos worn for the long period in various chronic diseases in traditional medicine. Yearning of the current review is to search the literature for the pharmacological properties, toxicity studies, pharmacology studies, Antibacterial and Antifungal, phytochemical exploration of Anti-inflammation, Anti-diabetic studies, antioxidant etc., and the amassed data helpful for the researchers to give attention on the significant areas of research yet to be revealed This Natural medicinal plant should be initiated towards conservation. Research plans involving drug synthesis mediating this medicinal plant might use this review approaches in future drug designing studies and formulate appropriate ideologies.

Keywords: Aegle marmelos, antioxidant, ayurvedic, novel drug, ethno botanical

Introduction
India is a country with large ethnic society and has immense wealth due to which it is rich in biodiversity. There are 45,000 species of wild plant out of which 9,500 species are ethno botanically important species (Abhijit Dutta et al., 2014) [2]. Apart from being a medicinal plant, Aegle marmelos is a sacred tree, dedicated to Lord Shiva. The offering of bael leaves is a compulsory ritual while the worship of Lord Shiva in the hills. This importance seems largely due to its medicinal properties. All parts of this tree, viz., root, leaf, trunk, fruit and seed, are used for curing one human ailment or another (Parmar, and Kaushal. 1982) [3]. All parts of the tree are used as herbal medicine in Ayurved, Unani and Siddha systems of medicine for the treatment of various ailments like dysentery, dyspepsia, chronic diarrhea (Sankeshi et al., 2013 and Reddy et al.,2012) [4,5]. Herbal drugs are traditionally used in various parts of the world to cure different diseases. The trend of using natural products has increased and the active plant extracts are frequently screened for new drug discoveries (Sridhar, 2002) [6], ‘Bael tree’ is native to India and a sacred plant to Hindus. It has got immense medicinal values. The Bael leaves are also used on Vinayakachavithi festival to worship Lord Ganesha (Sampath kumar et al., 2012) [7]. Aegle marmelos Linn. is a perennial tree, wild in the sub Himalaya tract, central and South India This plant is commonly called as Bael in Hindi, Vilvam in Tamil and Bilva in Sanskrit? It belongs to the family Rutaceae. It is indigenous to India and is used in folk medicines. The Ayurvedic practitioners use almost all of their parts but the greatest medicinal value ascribed to its fruits. Oxidative stress is produced during normal metabolic process in the body as well as induced by a variety of environmental and chemical factors which cause generation of various reactive free radicals and subsequent damage to macromolecules like DNA, Proteins and Lipids. No specific scientific evaluation of antioxidant activity of A. marmelos fruit pulp has been reported so far (Rajan et al. 2011) [8]. The phytochemical research based on ethno-pharmacological information is generally considered an effective approach to the discovery of new effective agents from plant extracts it is used to identify secondary metabolites Tamizhazhagan et al., 2017) [99]. Uncontrolled diarrhea is dangerous as it can lead to loss of body fluid results in electrolyte imbalance. Excessive loss of body fluid results in severe dehydration and death. In developing countries, diarrhea continues to be one of the leading causes of mortality and morbidity in children less than 3 years old. According to World Health Report, diarrhea is cause of 3.3% of all deaths. Worldwide distribution of diarrhea accounts for more than 5 – 8 million deaths each year in children. The incidence of diarrhoeal disease still remains high despite the effort by many government and international organizations to reduce it (Shariff et al., 2010, Sunilson et al., 2009, Chitme et al., 2004) [9, 11]. They are regarded secondary metabolic activity because the
plants that manufacture them may be having little need for the human population (Tamizhazhagan and Pugazhendy, 2017) (72). Asia has abundant species of medicinal and aromatic plants and traditional medicines have practiced in Asia since ancient times. India has made use of medicinal plants to cure ailments since thousands of years (Tamizhazhagan et al., 2017) (73). Hence, in the present review monitoring plant conservation and awareness develop health and aromatic, it generates resurfacing, reconstitution, and helps to relieve ailments since thousands of years (Tamizhazhagan et al., 2017) (73). Hence, in the present review monitoring plant conservation and awareness develop modern life. This review might extend help to investigators, health professionals, scientists and scholars working in the field of pharmacology and therapeutics to develop various drugs synthesis routes and build new remedies for various diseases Table 1 and 2.

### Table 1: Aegle marmelos classification

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae – Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subkingdom</td>
<td>Tracheobionta – Vascular plants</td>
</tr>
<tr>
<td>Superdivision</td>
<td>Spermatophyta – Seed plants</td>
</tr>
<tr>
<td>Division</td>
<td>Magnoliophyta – Flowering plants</td>
</tr>
<tr>
<td>Class</td>
<td>Magnoliopsida – Dicotyledons</td>
</tr>
<tr>
<td>Subclass</td>
<td>Rosidae</td>
</tr>
<tr>
<td>Order</td>
<td>Sapindales</td>
</tr>
<tr>
<td>Family</td>
<td>Rutaceae</td>
</tr>
<tr>
<td>Genus</td>
<td>Aegle Corr. Serr. – aegle P</td>
</tr>
<tr>
<td>Species</td>
<td>Aegle marmelos (L.) Corr. Serr. – Indian bael Pl(Figure 1)</td>
</tr>
</tbody>
</table>

**Fig 1: Aegle marmelos, plant**

### Table 2: Phytomedicine Studies of Aegle marmelos

<table>
<thead>
<tr>
<th>S.No</th>
<th>Phytomedicine Studies</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Antioxidant Activity</td>
<td>[12,14,31-38,96-98]</td>
</tr>
<tr>
<td>2.</td>
<td>Pollination efficiency</td>
<td>[13,14]</td>
</tr>
<tr>
<td>3.</td>
<td>Wound Healing Activity</td>
<td>[17]</td>
</tr>
<tr>
<td>4.</td>
<td>Anti-Diabetic activity</td>
<td>[18-21,39-43]</td>
</tr>
<tr>
<td>5.</td>
<td>Hepatoprotective activity</td>
<td>[22-23,76]</td>
</tr>
<tr>
<td>6.</td>
<td>Antimicrobial activity</td>
<td>[24-27,83-90]</td>
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<tr>
<td>7.</td>
<td>Antiulcer activity</td>
<td>[28-30]</td>
</tr>
<tr>
<td>8.</td>
<td>Anti-inflammatory activity</td>
<td>[44-47]</td>
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<tr>
<td>9.</td>
<td>Antifungal activity</td>
<td>[48-50]</td>
</tr>
<tr>
<td>10.</td>
<td>Antibacterial activity</td>
<td>[51-54]</td>
</tr>
<tr>
<td>11.</td>
<td>Antiviral activity</td>
<td>[55-58]</td>
</tr>
<tr>
<td>12.</td>
<td>Anticancer activity</td>
<td>[59-64,77-78]</td>
</tr>
<tr>
<td>13.</td>
<td>Radioprotective activity</td>
<td>[65,59,91-94]</td>
</tr>
<tr>
<td>14.</td>
<td>Antihyperlipidaemic activity</td>
<td>[36,43,66]</td>
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<tr>
<td>15.</td>
<td>Antifertility activity</td>
<td>[74,95]</td>
</tr>
<tr>
<td>16.</td>
<td>Antidiarrheal activity</td>
<td>[79-82,100-101]</td>
</tr>
</tbody>
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Number indicate [] references

### General information of Antioxidant Activity

Antioxidants that are reducing agents can also act as prooxidants. For example, vitamin C has antioxidant activity when it reduces oxidizing substances such as hydrogen peroxide; however, it will also reduce metal ions that generate free radicals through the Fenton reaction.

### Pollination efficiency

Pollination is important because it leads to the production of fruits we can eat, and seeds that will create more plants. Pollination begins with flowers. Flowers have male parts that produce very small grains called pollen. Pollination is the transfer of pollen grains from one flower to another.

### Wound Healing Activity

Wound healing is a natural restorative response to tissue injury. Healing is the interaction of a complex cascade of cellular events that generates resurfacing, reconstitution, and restoration of the tensile strength of injured skin.

### Anti-Diabetic activity

Drugs used in diabetes treat diabetes mellitus by lowering the glucose level in the blood. With the exceptions of insulin, exenatide, liraglutide and pramlintide, all are administered orally and are thus also called oral hypoglycemic agents or oral anti-hyperglycemic agents.

### Hepatoprotective activity

Hepato protection or anti-hepatotoxicity is the ability to prevent damage to the liver. This is opposite to the hepatotoxicity.

### Antimicrobial activity

Antimicrobial activity refers to the process of killing or inhibiting the disease causing microbes. Various anti-micro bialagents are used for this purpose. Antimicrobial may be anti-bacterial, anti-fungal or antiviral.

### Antiulcer activity

Other antiulcer drugs include mucosal protective agents such as sucralfate and prostaglandin analogues (misoprostol). Sucralfate (Carafate and others) is a sulfated polysaccharide that becomes a viscous polymer adhering to ulcers in mucosal surfaces and aiding in healing.

### Anti-inflammatory activity

Nonsteroidal anti-inflammatory drugs (NSAIDs) are drugs that help reduce inflammation, which often helps to relieve pain. In other words, they're anti-inflammatory drugs.

### Antifungal activity

An antifungal medication, also known as an antymycotic medication, is a pharmaceutical fungicide or fungistatic used to treat and prevent mycosis such as athlete's foot, ringworm, candidacies (thrush), serious systemic infections such as crypto cocal meningitis, and others.

### Antibacterial activity

Medicinal plants are considered new resources for producing agents that could act as alternatives to antibiotics in the treatment of antibiotic-resistant bacteria. The aim of this study was to evaluate the antibacterial activity of 28 plant extracts and oils against four Gram-negative bacteria species.

### Antiviral activity

Antiviral drugs are a class of medication used specifically for treating viral infections rather than bacterial ones. Most antivirals are used for specific viral infections, while a
broad-spectrum antiviral is effective against a wide range of viruses.

Anticancer activity
The MTT/MTS in vitro cell proliferation assay is one of the most widely used assays for evaluating preliminary anticancer activity of both synthetic derivatives and natural products and natural product extracts. The highly reliable, colorimetric based assay is readily performed on a wide range of cell lines.

Antifertility activity
Capable of or tending to reduce or destroy fertility: contraceptive antifertility agents.

Conclusion
Medicinal plant Aegle marmelos is used as an important ingredient in many Ayurvedic formulation and as a phyto medicine compound just on basis of its traditional medicinal uses It might generate researchers a good novel drug design and drug development using such a potent medicinal plant. It has made revolution in India’s indigenous Ayurvedic medicine system. Various Cultivated, Natural medicinal plants should be initiated towards initiated conservation. Research plans involving drug synthesis mediating through these medicinal plants might use this review approaches in future drug desining studies and formulate appropriate ideologies.

Acknowledgement
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References


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