The genus *Manilkara*: An update

Anjali, Vandana Garg, Anju Dhiman, Rohit Dutt and Sweety Ranga

Abstract
The genus *Manilkara* includes 135 plants that distributed worldwide. In this review, we had discussed three popular plants from Genus *Manilkara*, i.e. *M. bidentata* (A.DC.) is native to South America. *M. hexandra* (Roxb.) and *M. zapota* (L.) are native to South Asia. Above mentioned species from *Manilkara* i.e. *M. hexandra* and *M. zapota* are known for their medicinal properties and pleasant taste. Traditionally, these species are used in wound healing, inflammation, and fever. All the three species of the Genus have been largely explored for their anticancer and antibacterial activities.

Keywords: *M. zapota*, *M. hexandra*, ethnopharmacology, anticancer, antibacterial

1. Introduction
Literature of Genus *Manilkara* is organized from the chief directory such as Taylor & Francis, Forest Products Laboratory, Chemical abstracts, Annals of Phytomedicine, Scholars Research Library, PubMed, Research Gate, Elsevier, Academic Sciences, Pharma Scholars using as references. The given data of three species from *Manilkara* is categorized in to four parts i.e. Ethnopharmacology, morphology, chemical constituents, and pharmacological activities. The ethnopharmacological uses includes its traditional and other medicinal uses.

Taxonomic Nomenclature
The classification of Genus *Manilkara* is as follows: [1]

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae (plants)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub kingdom</td>
<td>Tracheobionta (vascular plants)</td>
</tr>
<tr>
<td>Super division</td>
<td>Spermatophyta (seed plants)</td>
</tr>
<tr>
<td>Division</td>
<td>Magnoliophyta (flowering plants)</td>
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<tr>
<td>Class</td>
<td>Magnoliopsida (dicotyledanaceae)</td>
</tr>
<tr>
<td>Sub class</td>
<td>Dilleniidae</td>
</tr>
<tr>
<td>Order</td>
<td>Ebenales</td>
</tr>
<tr>
<td>Family</td>
<td>Sapotaceae</td>
</tr>
<tr>
<td>Genus</td>
<td><em>Manilkara</em> Adans. (Manilkara)</td>
</tr>
<tr>
<td>Species</td>
<td><em>M. bidentata</em> (A. DC.), <em>M. hexandra</em> (Roxb.), <em>M. zapota</em> (L.)</td>
</tr>
</tbody>
</table>

Biological Description of Three Species

<table>
<thead>
<tr>
<th>Name of species</th>
<th>Common names</th>
<th>Synonyms</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>M. bidentata</em></td>
<td>Bulletwood, Balata rouge, Quinilla</td>
<td><em>Achras bulata</em> Aubl., <em>Manilkara balata</em> (Aubl.) Dubard; <em>Manilkara balata</em> var. cruegeri (Pierre) Dubard; <em>Manilkara balata</em> var. hartii (Pierre) Dubard; <em>Manilkara balata</em> var. schomburgkii (Pierre) Dubard; <em>Manilkara balata</em> var. sieberi (A.D.) Dubard; <em>Manilkara darienensis</em> (Pittier) Standl.; <em>Mimusops bulata</em> (Aubl.) CF Gaertn.; <em>Mimusops bulata</em> var. gutta Pierre; <em>Mimusops balata</em> var. melinonis Pierre; <em>Mimusops surinamensis</em> Miq.; <em>Sapota mulleri</em> Blume ex Bleekode</td>
<td>[2]</td>
</tr>
<tr>
<td><em>M. hexandra</em></td>
<td>Khimi, Ryan, Rania</td>
<td><em>Mimusops indica</em> (A. DC.)</td>
<td>[4]</td>
</tr>
</tbody>
</table>
Morphological Features

*M. bidentata* [6]
- **Leaves:** The leaves are alternate, elliptical and dark green, around 11-24 cm long.
- **Flowers:** It bears small white colored flowers having 0.5-1.5 cm length approximately.
- **Fruits:** Fruits are yellow berries with 3-5 cm or 1.2-2.0 inch diameter.

*M. hexandra* [4, 7]
- **Leaves:** Leaves are found to be alternate, elliptical, estipulate and rounded at apex. These are 2.5-11 × 1-6 cm in size.
- **Flowers:** It bears small white color flowers with 3-6 flowers in axillary fascicles. Peduncles of flowers are shorter than petioles.
- **Fruits:** It bears oval, sweet edible berry fruits with one or more seeds.

*M. zapota* [8]
- **Leaves:** Sapodilla is an evergreen tree. The leaves of this tree may length from 5 to 20 cm or 2 to 5 inches. These are rigid, sharp and are aggregated like bundle at the end of shoots.
- **Flowers:** It bears off-white, small, bell-shaped and bisexual flowers. The size of flowers may range from 9.5 mm or 3/8 inch in diameter.
- **Fruits:** Fruits of *M. zapota* are oval or round shaped. Color of fruit is brown, shaggy and leather-like with 2-4 inch diameter. It becomes gentle on ripening.

Ethnopharmacology

Traditional Uses

*M. bidentata* was traditionally used to cure various ailments. Stem was used to cure dysentery and nausea, fruits may be useful to treat constipation and their leaves were used for treatment of paralysis of limbs [9]. Traditionally, the decoction of stem of *M. hexandra* was used to prevent diarrhea, fever and stomach infections by Koli tribe [10]. *M. hexandra*’s bark was also known for its astringent property and powdered seeds mixed with honey were also used to cure redness in eyes [11]. Decoction from bark of *M. zapota* was used against diarrhea, peludism [12] and dysentery. Leaves were also beneficial to treat cough and cold symptoms [13].

Alternative and complimentary medicinal uses

Wood of *M. bidentata* is known to resist growth of brown- and white-rot fungus and dry wood termite. Hence, it may be best for manufacturing of furniture, billiard cues, violin bows and flooring [14]. *M. hexandra* can be used as anti-inflammatory and antigout agent [15]. It can be used in treatment of colic dyspepsia, hyper-dyspepsia and as anthelmintic [16]. The fruits of *M. hexandra* are known to contain rich amount of carbohydrates, iron, minerals, proteins and sugars. Viably, it may be used for the vegetative propagation of Sapota in various regions in Worldwide [4]. *M. zapota* is widely known for its sweet taste and medicinal properties. Almost all parts of *M. zapota* such as leaves, fruit, stem bark and roots possess antioxidant [17], anticancer [18, 19], antimicrobial [20], antipyretic and anti-inflammatory activities [21].

Phyto-Constituents

The chemical constituents present in the given plants of genus *Manilkara* are as follows:

*M. bidentata:* Various phytoconstituents were extracted from different seeds of *M. bidentata* such as 2,6,10,14,18-pentamethyl-2,6,10,14,18-eicosapentaene was identified in n-hexane extract, 9- octadecenolic acid and (Z)-2,3-dihydroxypropyl ester was identified from chloroform extract, (Z)-ethyl oleate was extracted using ethyl acetate as solvent whereas Z,E-2-methyl-3 and 13-Octadecadien-1-ol are identified in ethanol and methanol extracts [22].

*M. hexandra:* Stem and stem bark of *M. bidentata* contains cinnamic acid esters of α- and β-amyrins, ursoic acid, taraxerol and α-spinasterol [23]. The inositol and quer cetol were also identified in roots. [24]. Henricotanates, β-sitisterol derivatives and cinnamic acid were also reported in leaves and mesocarp of *M. bidentata* [7].

*M. zapota:* Leaves and seeds of *M. zapota* contain D- quercitol, myricetin-3-O-α-L-rhamnose, sapotin, sapotinone and saccharose [25]. Methyl chlorogenate, quercetin, (+)- catechin, (+)-gallocatechin, myricitrin, (−)-epicatechin, polyphenol oxidase, methyl chlorogenate, quercetin, (+)- catechin, (+)-gallocatechin and β-carotene are the phytoconstituents which were identified in all parts of the plant i.e. leaves, flowers, fruits, stem and the root [26-28].

Pharmacological Activities

Leaves of *M. bidentata* can be utilized as anti-inflammatory and anti-ageing, in formulations of pharmaceuticals as well as in cosmetics products [30]. Leaves extract of *M. hexandra* also possess antiarthritic activity [19]. Its bark may be also useful in helminthiasis and jaundice [10]. Both methanol and ethanol extracts of *M. zapota* have good antioxidant activity [31]. The leaves, fruits and stem of sapodilla are reported to have analgesic and anti-inflammatory [32], anti-diabetic [33] and anti-diarrhoeal [34] activities. The ethyl acetate and aqueous extracts of leaves of *M. zapota* have antifungal activity against Alternaria alternate, Aspergillus Niger, Candida albicans, Curvularia lunata, Fusarium eumartii, Mucor hiemalis, Penicillium chrysogenum, Rhizopus stolonifer and Saccharomyces cerevisiae [35]. Methanol extract of *M. zapota* showed best antibacterial activity against Pseudomonas aeruginosa, Salmonella typhimurium and Enterobacter aerogenes [36]. The ethyl acetate extract of leaves fruits [36] and stem bark [20] of the *M. zapota* was reported against EAC cell lines. Methanolic extract of the plant showed cytotoxic activity against EAC, NAML-6, MCF7, K-562 and T47D cancer cell lines [18].

Conclusion

About 135 species of the genus *Manilkara* have been reported in various floras. An exhaustive literature survey revealed that information is available on three species amongst others. Pharmacological studies infer that *M. bidentata* exhibits anti-inflammatory and also used to treat paralysis of limbs; *M. hexandra* exhibits anti-arthritis, anti-inflammatory, analgesic, diuretic, antiulithiatic, antipyretic, antimicrobial activities. *M. zapota* exhibits antioxidant, analgesic, anti-inflammatory, antimicrobial and antitumor activities. Therefore, Genus *Manilkara* hold great potential in investigations of various
pharmacological activities present in various species.

References