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A REVIEW ON AEGLE MARMELOS

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Introduction:-

Plants have served as natural sources of medicinal compounds for millennia. Many individuals rely on a range of plant products to address various physical and mental health issues. These plants play crucial roles in traditional medicine systems like Chinese, Ayurvedic, Siddha, Unani, and Tibetan practices. Ancient texts, such as the Rigveda and Charaka-Samhita, highlight the health benefits of certain plants. Over the past fifty years, advanced scientific methods have revealed numerous medicinal properties of these plants, including anti-cancer, antimicrobial, antifungal, and anti-inflammatory effects. *A. marmelos*, also known as the wood apple and native to India, is significant in both traditional and folk medicine. Traditionally used for treating diarrhoea and dysentery, it also has cultural significance in temple rituals. This review aims to explore the morphology, distribution, phytochemistry, and medicinal benefits of *A. marmelos*, and to identify future research opportunities for developing therapeutic compounds. [1]

Traditional medicine plays a crucial role in patient care, with approximately 80% of the global population relying on it for primary health needs. Phytochemicals from medicinal plants have emerged as valuable sources for new drugs across traditional systems, modern pharmaceuticals, nutraceuticals, food supplements, and synthetic medicines. These compounds often demonstrate preventive and therapeutic properties, typically supported by preclinical animal studies. Many Ayurvedic plants are already known for their effectiveness and hold promise for future human applications. [2]

Scientific classification [3]:

Kingdom: - Plantae
 Clade: - Tracheophytes
 Clade: - Angiosperms
 Clade: - Eudicots
 Clade: - Rosids
 Order: - Sapindales
 Family: - Rutaceae
 Subfamily: - Aurantioideae
 Genus: - *Aegle Correa*
 Species: - *A. marmelos*
 Binomial name: - *Aegle marmelos* (L.)
 Synonyms: - *Belou Marmelos* (L.) *A. Lyons* *Crateva marmelos* L.

The different vernacular names of *Aegle marmelos* in India and other Southeast Asian countries [4]:-

Language	Names
Sanskrit	Bilva, sriphal, shivadruma, Shivapala
Hindi	Bel, bael, sripal
Telgu	Maredu
Bengali	Bel
Gijrati	Bil
Kannada	Bilpatra, kumbala, malura
Tamil	Kuvalum
Thai	Matum and mapin
Cambodia	Phneou or pnoi
Vietnamese	Bau nau
Malayan	Maja pahit
French	Oranger du Malabar
Portuguese	Marmelos
Java	Modjo

Biological source:

A pod consists of unripe or underripe fruits, their fragments, or irregular pieces of *Aegal marmelos cor*, Family *Rutaceae*.

Geographical sources:

It is also cultivated in the sub-Himalayan region and all over India, particularly central and southern India, Burma, and wild bike tarani.

Collection :-

The height of the tree is about 12 meters. Hai is a sacred tree, and the leaves, known as bilipatra, are used to worship Lord Shankara. The tree has strong, straight spines, compound trifoliolate leaves, and berry fruits. The fruits are collected between April and May. After collection, the epicary is removed and usually cut into transverse slices or irregular pieces. [5]

Bell's Cultural Practices [6]:**1) All-weather soil**

Although mulberry originates from subtropical regions, it is highly adaptable and thrives in tropical, arid, and semi-arid climates. It grows effectively on limestone and produces fruit in a variety of soil types, including loamy or rocky soils with a pH between 5 and 8. The tree requires a dry period to fruit successfully. In India, mulberry is renowned for flourishing in conditions where other fruit trees struggle to grow.

2) Planting:

The monsoon is the best time for sowing. However, if irrigation is available, planting can also be done in the spring. Pits of size 1 m x 1 m x 1 m should be dug at least one month before the onset of the monsoon. Planting furrows are separated for 20–25 days, then filled with a mixture of topsoil and 10–15 kg of cow dung. After this, the pits can be irrigated to stabilize the soil. If irrigation is causing depression, add potting mix to the hole. Plant the bell plant in the center of the pit and support the plant. Make a basin around it and give it water gently. Mulch with dry leaves to retain moisture.

3) Irrigation:

Regular watering at monthly intervals during the summer and winter is essential for the rapid growth and development of young plants. Boring trees do not need irrigation during dry summers, as they lose leaves and resist hot, dry summers with new leaves.

4) Harvesting and Yield:

Budded and grafted trees start fruiting 4-5 years after planting, saplings 8–10 years after planting, bell fruit takes 8–10 months to mature, and fruit sets take 10–12 months to ripen. Bell is a climacteric fruit that can be harvested from the tree if harvested at the right stage of maturity. Maturity can be determined by the color of the skull, which changes from dark brown to yellowish green. Ripe fruits should be picked from 5-cm fruit stalks. A fully grown (10–12 years old) sprouted or grafted bell tree yields an average of 150–200 fruits under good management practices. Fruits can be stored for two weeks at room temperature. At 10 °C, they can be stored for up to three months. The average yield is 300–400 fruits per tree. Fruit quality is highly correlated with seed sac weight and size. The larger and heavier the seed sacs, the more volume, mucus, and poor quality.

5) Training and sharing:

Bell plants can be trained as improved central leaders. Pruning is done twice a year, once in Maine and the other in August. Pruning is limited to removing dead and diseased branches in Maine, while healthy leaves are pruned for sale in August.

Morphology:- [5]

Odour	Aromatic
Taste	Mucilaginous
Shape and Size	Sub-spherical berry, 5–10 cm in diameter
Epicarp	Hard, woody, externally reddish-brown, smooth or granular.
Mesocarp and Endocarp	Consist of pulp which is reddish-brown and made up of 10–12 carpels. Each carpel contains several seeds with oblong, flat, multicellular, woolly white hairs. Seeds are surrounded by mucilage.

Description :-

Aegle marmelos is a deciduous shrub or small to medium-sized tree. Up to 13 meters (43 feet) tall with slender branches and a rather erect, irregular crown.



Fig No 1- Images of Aegle marmelos (L.)

- **Bark:** - Bark pale brown or grey, smooth or finely fissured and swollen, armed with long straight spines, 1.2–2.5 cm (1/2–1 in) singly or in pairs, often exuding fine sap from the cut. The gum is described as a clear, sticky sap, resembling gum aspic, exuding from wounded branches and hanging in long strands, gradually thickening. Hair tastes sweet at first and then burns in the stomach. [7]
- **Leaves:** - Leaves trifoliate, pinnate, each leaflet 5–14 cm (2–5+1/2 in) x 2–6 cm (3/4–2-1/4 in), tapering or ovate with pointed tip and rounded base, toothless or shallow rounded teeth. Young leaves are pale green or pink in colour and finely hairy, while mature leaves are dark green and completely smooth. Each leaf has 4–12 pairs of lateral leaflets that are joined at the margin.
- **Flowers:** - 1.5 to 2 cm, pale green or yellowish, sweetly scented, bisexual, in short drooping axillary clusters at the ends of branches and leaves. They usually appear with young leaves; the calyx is flat with four small teeth. 6–8 millimetres (1/4–3/8 in), four or five petals overlap the bud, numerous stamens with short filaments, and pale brown, short-style anthers. The ovary is bright green with an inconspicuous disc. [8]
- **Fruits:** - The diameter of the fruit is usually between 5 and 10 cm (2 and 4 inches). They are round or slightly pear-shaped. It is shaped and has a thick, hard rhododendron that does not split when ripe. The bark is smooth and green. It is yellow when ripe, grey until fully ripe, and has 8 to 15 or 20 segments of fragrant orange. It is filled with pulp, each segment containing 6 to 10 flat oblong seeds, each 1 cm. long. The hair and each segment are enclosed in a sac of sticky, transparent mucilage that hardens when dry. The exact number of seeds varies in different publications. The fruit takes about 11 months to ripen on the tree, reaching maturity in December. It can reach the size of a sweet grape or pomelo, and some are even larger, with shells so hard that they must be broken with a hammer or machete. The fibrous, yellow pulp is very aromatic. It is described as tasting the mouth and smelling of roses. Boning (2006) suggests that yaw is sweet, aromatic, and pleasant, although in some varieties it is pungent and astringent with honey. It looks like marmalade made partly of citrus and partly of tamarind. Asymmetric, hairy bipa is encased in a fine mucilage. [9]

Bell fruit is highly nutritious. The analysis of the fruit reflects the following values: 61.5 g of moisture, 18 g of protein, 0.39 pam barbi, 318 g of carbohydrates, 17 g of minerice, 55 mg of carotene, 0.13 mg of chiamin, 119 mg of riboflavin, 1.3 mg of vitamin C and 1.1 mg of vitamin C, and 100 grams of edible portion. [10]

Various parts of *A. marmelos*, according to their phytochemicals and uses, are described below:-[11,12]

Sr no	Plant Parts	Phytochemicals	Uses
1	Leaves	Skimmianine, aeglin, rutin, γ -sitosterol, β -sitosterol, flavone, lupeol, cineol, citral, glycoside, o isopentenyl, halfordioli, marmeline, citronellal, cuminaldehyde phenylethyl, cinnamamides, eugenol, marmesinin.	The leaves are most effective in treating fever, nausea, vomiting, swellings, dysentery, dyspepsia, seminal weakness, and intermittent fever.
2	Fruits	Marmelosin, Luvangetin, Aurapten, Psoralen	Bael fruits are edible. The pulp used to make delicious items like murabba, puddings, and juice. Apart from their laxative use and curing respiratory ailments, also used in several traditional medications to treat chronic diarrhea, peptic ulcers, inhibit lipid peroxidation, free radicals scavenging, antioxidants, anti-ulcerative colitis, gastroprotective, hepatoprotective, antidiabetic, cardioprotective, radioprotective, antibacterial, antidiarrheal and antiviral

			properties.
3	Flower		An anti-dysenteric, antidiabetic, diaphoretic, and local anesthetic medication can be produced by distilling flowers. It is utilized as a tonic for the stomach and intestine. Along with being used as an expectorant, it is also helpful in epilepsy.
4	Bark	Fagarine, Marmin.	The villagers use a decoction of the bark to treat fever and cough.
6	Seed	D-limonene, A-D-phellandrene, Cineol, Citronellal, Citral, P-cymene, Cumin aldehyde.	Seed extract possesses antidiabetic and hypolipidemic effects in diabetic rats.
7	root		The roots of bael are thought to be effective in treating urinary problems, preventing heart palpitations, and curing fevers. They are also said to relieve abdominal pain. The medical properties of dashamula lie in its root to treat fever, diarrhea, and flatulence.

Bioactive Compounds: [11]

Phytochemicals are secondary metabolites of plants; for example, flavonoids, phenolics, carotenoids, alkaloids, polysaccharides, colors, and terpenoids have health-promoting properties (Chhikara et al., 2019). Mamelogs contains abundant phytochemicals, which are responsible for its numerous health benefits. Snehlata, Sheel, and Kumar (2018) reported various bioactive compounds, namely, alkaloids (15.75 ± 0.25), claviconoids (42.75 ± 0.45), phenols (30 ± 0.5), and phenols (30 ± 0.5). Saponins ($3.6590.510.58$ and $20.5, 7$) in leaves.

- **Coumarins:** - Coumarins are benzopyrones (1, 2-benzopyrones, or 2H-1-benzopyran-2-ones). It is a family of compounds that act as aroma enhancers and have medicinal uses such as bacteriostatic, antifungal, antitumor, and blood-thinning activities. Coumarins present in A. marmelos include sesquiterpene coumarins, diterpene coumarins, damterpene coumarins, auraptene, epoxyurashtin, marmelosin, imperatorin, alloimperatorin, scoperin, scopolitanin, and umbelliferone. Coumarin has food and medicinal importance. The roots of A. marmelos contain agelinol, marmesin, marmin, psoralen, scopoletin, umbelliferone, xanthotoxin, studied the effect of ripening on marmelosin and psoralen content and found that the concentration of these bioactive compounds decreased when coumarin ripened, increased venous blood flow rate, and decreased capillary permeability. Marmelosin and marmin have antimycobacterial effects.
- It has a growth inhibitory effect against tuberculosis H763 and against Mycobacterium bovis. Marmelosin (C₁₃H₁₂O₃), present in A. marmelos, has been shown to be effective in relieving stomach problems. High Coumarin is toxic in high doses and should not be taken during the use of anticoagulants. Heraclenin (C₁₆H₁₄O₅) is a linear furocoumarin found in bells with a molecular mass of 286 g/mol and a melting point of 112-114 °C. Heraclenin has many health benefits, such as anti-inflammatory, anti-coagulant, cytotoxic, phototoxic, and phototoxic properties. the heraclenin compound in bell foot improves osteoblast differentiation, mineralization, and bone regeneration. isolated heraclenin from fruit pulp and showed antifungal activity against Xanthomonas oryzae and Colletotrichum lindemuthianum.
- **Alkaloids :-** Alkaloids are natural, nitrogen-free plant secondary metabolites that are biologically active. A. Marmelin (2)-N-(2-hydroxy-2-[4-(3-methylbut-2-enoxy) phenylethyl] -3-phenylprop-2-enamide, containing phenylethyl cinnamides (N-2-(4 Marmelos)) are (30,30 dimethyloloxyl)phenyl ethylcinamide (4-hydroxyphenyl)ethylcinnamide (N-4-methoxystyrylcinnamide) and agelin ((Re)-N-2-hydroxy-2-(4-methoxyphenyl)ethyl)-3-phenylprop-2-enamide) isolated from the leaves of A. marmelos. Phenylethyl cinnamides with A-glucosidase inhibitory activity are responsible for the anti-diabetic properties of the plant. Hai alkaloid compounds are responsible for improving the visual system, prefrontal cortex, thalamus activity, insecticidal, demulcent, aetioplasmic, hepatoprotective, and inflammatory activity.
- **Phenylpropanoids:**-Phenylpropanoids are phenolic compounds with three carbon side chains attached to an aromatic ring and include lignans, hydroxycoumarins, and phenylpropane compounds distributed in plant parts. The methanolic extract of A. marmelos contains marmenol (7-geranyloxycoumarin [7-(2,6-dihydroxy-7-methoxy-7-methyl-3-octaenyloxy)coumarin]). The yellowish-green oil extracted from the leaves contains b-sitosterol-b-D-glucoside, rutin, marmesinin, and marmelosin, a characteristic aromatic pollutant synthesized in response to abiotic or biotic stress such as UV radiation and some adverse environmental conditions, and contains free radicals. has scavenging as well as antioxidant properties. These compounds have various therapeutic properties as UV screens, immunosuppressive, anti-inflammatory, anticancer, antioxidant, antiviral, antibacterial, and wound healing agents.
- **Flavonoids :-**Flavonoids, which have good antioxidant capacity and numerous health benefits, are biologically active compounds. Flavonoids and phenolic acids present in A. marmelos are ellagic acid, gallic acid, chlorogenic acid, ferulic acid, kaempferol, protocatechuic acid, and quercetin. A. marmelos also contains flavone glycosides, rutin, flavan-3-ol, and palavin. Flavonoids present in A. marmelos have anti-cancer, hepatoprotective, free radical scavenging ability, anti-inflammatory, anti-cardiovascular, and antioxidant activity, and some more flavonoids. are able to act against viruses. A. As marmellose contains antiviral bioactive compounds, it can be used to boost immunity under simple conditions.
- **Terpenoids:** - Terpenoids are hydrocarbons, such as carotene, found in many plant essential oils, whose molecules contain isoprene units. The presence of p-cymene (17%) and a-phellandrene (56%) was reported in the leaf oil. A. marmelos also contains p-menth-1-en-3,5-diol. Liminene (82.4%) is the major constituent of plant leaves and can be used as a characteristic marker to identify A. marmelos oil (Patel and

confirm their properties. *A. In vitro* antidiarrheal activity of the dried fruit pulp of marmelos was reported. Antidiarrheal activity was determined by the MIC method against diarrhea-causing organisms. *Shigella* *Boydi*, *S. Sochei*, and *Ayer*; *Palexneri*, *S.* The ethanolic aka showed moderate to good activity against dysentery. A crude aqueous extract of the unripe fruit of *Marnelii* was screened for dieneose-inducing constituents. *Ako* was analyzed for antibacterial activity, antimicrobial activity, and atheroviral activity. *Akani* exhibited inhibitory activity against *Giardia* and *Rotavirus*, while the viability of none of the six bacterial strains tested was affected.

- **Anti-diabetic activity :-** Marmelos is used as a supplement to control diabetes. Various organic meanings and *A.* to evaluate the antidiabetic activity of fresh juice of marmels. Many scientific studies have been conducted on animal models. in streptozotocin-induced diabetic rabbits. The anti-diabetic potential of marmellose leaves and callus has been reported. All *Arconi* streptozotocins reduced blood sugar levels in diabetic rabbits. However, methanol extracts from various herbs, leaves, and callus produced the maximum antidiabetic effect. Antidiabetic activity of *Aegal* marmelos leaves was reported in alloxan-diabetic rats. Methanolic extract of *Aegle* marmelos v leaves (120 mg/kg body weight, ip) reduced blood sugar levels. A reduction in blood sugar was observed from the 6th day after continuous administration of the extract and 54% of the sugar level on the 12th day.
An aqueous extract of the leaves of *Aegal* marmelos was evaluated for hypoglycemic and antioxidant properties. this extract may be useful in the long-term management of alloxon-induced diabetes in male albino rats and *AML* diabetes. Similarly, the hyperlipidemic activity of the aqueous extract of *Aegal* marmelos fruits was demonstrated in streptozotocin-induced diabetic *Wistar* rats. worked with the alcoholic extracts of *Aegle* marmelos, *Momordica* *charantia*, and *Eugenia* *jambolana* independently and confirmed their protective activity against streptozotocin-induced diabetic rats and against laboratory-induced cell necrosis. studied *Aegle* marmelos on alloxan-induced diabetes. studied and reported leaf extracts. Increasing antioxidant levels that lower blood glucose levels. In addition to all the above-cited work presented the overwhelming results of *Egal* marmelos and documented its hypoglycemic actions along with other pharmacological actions at the molecular level.[13]
- **Antiproliferative activity: -** Antiproliferative effects were reported on human tumor cell lines, with results consistent with human tumor cell lines including leukemic *K562*, *T-lymphoid* *Jurket*, *Blymphoid* *Rajal*, *erythroleukemic* *HEL*, *melanoma* *Colo 38*, *breast* *Tani* *MCFT*, and *NDAMES* *10* *Collins*.
- **Hepatoprotective effect: -** *A. marmalade* leaves have been reported to cause hepatoprotective-induced liver injury. Each of the albino goats was fed 30% *Barmelos* leaves for 21 days, for a total of 40 days. *TBARS* values were given. *A.* Effects on induced rats and healthy, alcohol-intoxicated, and herbal humm-treated animals were 123.35, 235.68, and 141.86 $\mu\text{g/g}$ tissue, respectively. The leaves of *A. marmelos* show excellent hepatoprotective effects.
- *Agal* marmelos leaf extract on alcohol-induced liver injury in albino rats and presented data of excellent liver protective effects. It also showed that aqueous jerk of bell foot pulp and seeds-induced *C014* *Kartans* are effective in the treatment and prevention of grapefruit toxicity.[13]
- **Antifertility effects :-** Antifertility effect of aqueous extract of *Amal* *Marmalos* *panra* in male albino rats (250 mg/kg body weight) Aqueous jerk of *Aegle* marmelos leaves was administered to rats for 45 days. Treatment reduced the weight of the testis, epididymes, and seminal vesicles. This extract improves testicular sperm count, epididymal sperm count, and low motility and abnormal sperm counts. *A. marmelos* leaves, seeds, and fruits have adverse effects on male fertility. *A. marmelos* bark extract is a rich source of *marmin* and *fagarin* known to reduce male fertility. *A. marmelostha* merthenolic extract determines the dose and duration depending on reproductive organ weight and serum testosterone levels. They report sperm density, motility, viability, and sperm integrity; the histopathological study of testes and spaces in the germinal epithelium; testicular cytotoxicity; and necrosis. Finally, while that study showed complete sterility in a time-dependent manner, the authors also reported that morphological as well as physiological parameters were fully restored in the extract-treated abdomens after withdrawal of treatment, findings suggesting that *A. marmelos* extract is effective for complete prevention of pregnancy after withdrawal of treatment. A strong candidate for male contraception to restore fertility quickly.[14]
- **Pest control properties :-** The essential oil of *A. marmelos* leaves has been reported to show insecticidal activity against four stored grain pests, namely, *Callosobruchus chinensis* (*L.*), *Rhapsoperdha dominica* (*F.*), *Sitophilus oryzae* (*L.*), and *Tribolium castaneum*. *A. marmellose* (500 $\mu\text{g/mL}$) was sprayed with essential oil. Grain loss due to oil processing as well as *T.* All pests except *Castaneum* showed weight loss in infested fumigated grain samples. The oviposition and emergence of adults of *C. chinensis* were significantly reduced in cowpea seeds treated with essential oil at different doses. The essential oils of *A. marmelos* leaves were reported to have insecticidal activity. Activity against *Sitophilus oryzae* and *Tribolium castaneum*.
- **Analgesic action :-** The leaves of *A. marmelos* were reported to have analgesic activity. A methanol extract of marmelos leaves was tested for analgesic activity by an acetic acid-induced writhing test in *Swiss* rats. The results indicated that methanol and acetic acid reduced the char-induced. Methanol extract (200 and 300 mg/kg body weight) showed significant analgesia.
- **Antiarthritis activity :-** *A. marmelos* leaves against collagen-induced arthritis in *Wistar* rats. Radiological and histological analysis of mice treated with methanol acne
- **Anti-inflammatory action :-** The raw fruit pupa of *A. marmelos* was reported to have anti-inflammatory activity. Injection of 0.1 ml of 1% *A* carrageenan into the subplanar side of the left hind paw of *Sprague-Dawley* rats induced swelling. The extract treatment of the inflamed rats significantly reduced the λ carrageenan-induced inflammation.
- **Anti-fungal activity :-** reported the antifungal activity of the erthenolic extract of *Agal* marmelos leaves, including antidiarrheal and antimicrobial activities. the antifungal activity of essential oils isolated from bell leaves using a spore germination assay. The oil showed variable efficacy against different fungal isolates and showed 100% inhibition of germination of all fungal spores tested at 500 ppm. They proposed that the essential oil of bell leaves, Ca^{2+} -*Dipicholic* acid, may interfere with the metabolic pathway. and possibly prevent spore formation. the antifungal activity of *Donolic* root extract against *Aspergillus fumigans* and *Triphyton* *metagrophytes*.
- **Anticancer activity :-** The *Bangladeshi* folk medicinal no. and used *Aegle* marmelos extract for cytotoxic activity using brine. *Shrimp* killing assays, *sea urchin* egg assays, and *MTT* assays using tumor cell lines showed toxicity in all assays used. Also, *Gagatia* *G. C.* et al. (2005)

reported the anticancer effects of a hydroalcoholic extract of bel leaves in an animal model of Ehrlich ascites carcinoma and proposed that the presence of schemianine in the extract may induce apoptosis.

The International Agency for Research on Cancer recently reported that cancer is the second leading cause of death worldwide, and in 2008, there were an estimated 12.7 million new cancer cases (of which 56% were in developing regions of the world) and 76 million cancer deaths. (63% in less developed regions). By 2020, cancer incidence is projected to increase threefold, with a disproportionate increase in cancer incidence in developing countries with limited resources to combat the problem [15].

- **Radioprotective Activity :-** Different effects of gamma radiation on rats. It studied the radioprotective effect of Aegle marmelos extract by dose exposure and found that oral administration of the extract increased radiation tolerance by 1.6 Gy. The effect of Arco on the peripheral blood and small intestinal flora of Swiss albino rats. They exposed animals to gamma radiation. When exposed and collecting data against radiation-induced changes in peripheral blood, spleen colony-forming units, and intestinal mucosa, intra-abdominal administration of Aegle marmelos significantly reduced the tumor effect.
- **Antispermatic Activity:-** Reported the antispermatic activity of an ethanolic extract of aegle leaves in marmelos rats. Presented data on rat sperm stasis through in vitro studies with the same workers; The ethanol extract of marmelos leaves was studied for its in vitro effect on sperm motility, and it was suggested that this extract has a significant effect on sperm motility. It has also been proposed that increased calcium concentrations reduce sperm count.
- **Antiulcer Activity :-** Reported orally that administration of pyranicomarins isolated from the seeds of Aegle marmelos korea showed significant protection against papillary-ligated and aspirin-induced gastric ulceration in rats and cold-associative stress-induced gastric ulcers in rats. Treatment of untreated rats with raw willow fruit significantly inhibited whole-ethanol-induced gastric mucosal damage.
- **Antithyroid Activity :-** Scopoletin (7-hydroxy-6-methoxycoumarin) isolated from the leaves of Aegle marmelos and evaluation of its ability to regulate hyperthyroidism, found that mice treated with levo-dyxoxine had scopoletin (100 mg/kg for 7 days) and reduced serum thyroid hormone levels. Scopiletin has superior therapeutic efficacy over the standard athyroid drug, and propyluracil activity has also been shown.
- **Toxicity studies :-** Total water content and total water content from leaves of water amalalo In an experimental study of their toxicity by collecting methanolic extracts, Bala Undir, A. No histopathological changes were observed when Marmelos extract was administered intraperitoneally for 14 consecutive days at a dose of 50 mg/kg body weight. A. marmelos leaf extracts have been reported to have high drug safety.

Other medicinal properties of bell fruit have been confirmed. [16]

- ★ Kayndical is scavenging for them.
- ★ Inhibition of lipid peroxidation
- ★ Bael prevents CC14-induced hepatotoxicity.
- ★ Bael in the heart-wrenching work
- ★ Bull fruit reduces intraocular pressure, which is a cause of glaucoma.
- ★ Bael's gastrointestinal dysfunction
- ★ Gastroprotective effect
- ★ marmelos prevents radiation sickness and death.

Marketed Products: [16]

- Food: jam, soft drinks, toffee, tamarind, sauce, marmalade, syrup using beel fruit.
- Fodder: Leaves and twigs are used for fodder.
- Timber is used for decking and construction. It is the base used for small turnery, tools, knife handles, pestles, and combs.
- Gums and Resins: Bael fruit and seeds that are added to the cement used for water-proofing walls and building walls.
- Tannin or Dyestuff: The tannin killed the dyestuff. Jarinin is present in the leaves, and the calyx is yellow.
- Essential oil: The leaves are used as an essential oil for hair oil.
- Poison: These leaves cause miscarriage and infertility in women. An important insect pest of the rice plant in Asia, leaf extract is used as a fish poison in Celebes.
- Medicinal Hemorrhoids: The use of raw bel fruit with fennel and ginger keeps the skin color normal. It is used in the treatment of leukoderma. Mermelosin is found in bell fruit for use as a laxative and diuretic. Dwamisha and dysentery are prevalent in India during the summer months.
- Other products: Bell fruit is used for detergent action on cloth. The flower is used as an ointment. (16)

Conclusion:-

From this review, it is clear that A. marmelos is an important medicinal plant and is widely used in Ayurveda, Siddha, and other systems of medicine. A. marmelos contains several phytoconstituents, which are major factors in the medicinal value of this plant. Almost all parts of this plant, such as leaves, fruits, seeds, bark, and roots, are used to treat various diseases. Pharmacologists develop new drugs from natural sources. Eager to develop, A. The development of modern medicine can be emphasized by Marmelos. Apadana bungalows for their development for economic and therapeutic use Systematic research and development work should be undertaken. The bioavailability and dosage of Bell's extract need to be verified with animal models and epidemiologic studies.

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