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Review on *Aeglemarmelous* a Potential Medicinal Tree

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Abstract: *Aeglemarmelos is a plant in the Rutaceae family that is one of the most significant in themedicinal field due to its properties. Bilwais used to treat a variety of medical problems. Since the time of the dinosaurs, this plant has existed. The plant contains a variety of pharmacological qualities, including wound healing, antipyretic potential, antidiarrheal activity, Diuretic activity, Ulcer healing, and more. Antithyroid activity, Immunomodulatory activity, Antifungal activity, Antimicrobial activity, Antioxidant activity, Radio protective effect, Contractile activity, Antiarthritis activity, Analgesic activity, Cytoprotectiveeffectuate-constipating effect. Alkaloids, Terpenoids, Vitamins, Coumarins, Tannins, Carbohydrates, Flavonoids, Fatty Acids, Essential Oils, and other miscellaneous chemicals are among the identified constituents. This study summarises information about the A. marmelos' morphology, distribution, phytochemistry, traditional uses, and biological activity.*

Keywords: Aeglemarmelous, Antioxidant, Analgesic, Morphology

I. INTRODUCTION

Bael or Bengal quince is a deciduous sacred tree, associated with Gods having useful medicinal properties, especially as a cooling agent. This tree is popular in '*Shiva*' and '*Vishnu*' temples and it can be grown in every house. Its leaves are trifoliate symbolizing the '*Thrimurthies*'- *Brahma, Vishnu, Shiva*, with spear shaped leaflets resembling "*Thrisoolam*" the weapon of Lord *Shiva*. Many legends, stories and myths are associated with this tree. The leaflets are given to devotees as '*prasadam*' in *Shiva* temples and as '*Tulasi*' in *Vishnu temples*

Distribution

Bael tree is native to India and is found growing wild in Sub-Himalayan tracts from Jhelum eastwards to West Bengal, in central and south India.

Documented Species Distribution

Native range: India Exotic range: Bangladesh, Egypt, Malaysia, Myanmar, Pakistan, SriLanka, Thailand

Local Names:

English (bael fruit, Indian bael, holy fruit, golden apple, elephant apple, Bengal quince, Indian quince, stone apple); Burmese (opesheet, ohshit); French (oranger du Malabar, cognassier du Bengale, belindien); German (Belbaum, Schleimapfelbaum, Baelbaum); Gujarati (bili); Hindi (baelputri, bela, sirphal, siri-phal, kooralam); Indonesian (majabatuh,maja); Javanese (modjo); Khmer (bnau); Lao (Sino-Tibetan) (toum); Malay (bilak,bel, bila,majapahit); Portuguese (marmelos); Thai (matum, mapin, tum); Vietnamese (trai mam, mbaunau)

Yield: The average yield is 300-400 fruits per tree. [1]

Plants have been used as a natural source of medicinal compounds since thousands of years. Bael (AegleMarmelos (Linn), family Rutaceae,is also known as Bale fruit tree, is a moderate sized, slender, aromatic tree, 6.0 -7.5 m in height, and 90 to 120 cm in width, ascending to an altitude of 1200 meter in the western Himalayas [2]. A. marmelos plant and their plant products are used to cure and relief from physical and mental illness. These plants are used in traditional Chinese, Ayurveda, Siddha, Unani and Tibetan medicines. Ancient literature such as Rigveda, Yajurveda, Atharvaveda, CharakSamhita and SushrutSamhita also describes the use of plants for the treatment of various health problems [3]. These plants are also used for the treatment of several medicinal properties such as an anticancer activity, antibacterial activity, antifungal activity, antidiabetic activity, antioxidant activity, hepatoprotective activity, haemolytic activity, larvicidal activity and anti-inflammatory activity etc and also used in treatment of diarrhea and dysentary. Leaves of A. marmelos used to cause infertility/abortion in women[4] .

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Origin & Distribution[5,6]:

The Bael tree is originated from Eastern Ghats and Central India. The native place of A. marmelos is INDIA. A. marmelos is found growing along foothills of Himalayas, Bihar, Uttarpradesh, Jharkand, and Madhya Pradesh and it is also grown in some Egyptian gardens in Surinam and Trinidad. Aeglemarmelos is widely distributed in India, China, Nepal, Sri Lanka, Pakistan, Bangladesh, Indonesia, Malaysia, Tibet, and Philippines and it also found almost in all the states of India

Plant profile- aeglemarelos is slow growing, medium sized tree, up to 12-15-metre-tall with short trunk, thick, soft, flaking bark and sometimes spiny branches. Young suckers wear many stiff, straight spines. Bael is deciduous tree having alternate leaves, borne singly or in a group, are composed of 3-5 oval, pointed and shallowly toothed leaflets, - which are 10 cm long 2-5 cm wide, the terminal one with a long petiole[7]

Habitat and Distribution

Bael is native to India and usually available in the range of Himalaya to west Bengal. It grows around foothills of Uttar Pradesh, Chhattisgarh, Bihar, Madhya Pradesh, Uttranchal, Jharkhand7 . The exotic range of bael is Bangladesh, Egypt, Malaysia, Myanmar, Pakistan, Srilanka, Thailand[8].

Nutritional Use of Bilwa

Physiochemical study of bilwa shows that this plant has incredible nutritional value as well. Bilwa pulp is rich source of glucose and sugar, also used as energy drink with milk. Other nutrients present in bilwa are proteins, fats, fibre, calcium, minerals, iron, vitamin A, vitamin B1, vitamin C, riboflavin [9]. The leaves and shoot are used as a green vegetable in Indonesia[10] .

Aeglemarmelos is commonly known as Bael, bilva golden apple, Indian quince and stone apple[11]. A. marmelos (Bael tree) belongs to the citrus family Rutaceae[12] . It is the most significant underutilized medicinal, Indigenous fruit crop of India. This plant is of high economic value and is known in India since 800 B.C. as per historical reports. In 1629 A.D., the Chinese Buddhist pilgrim, HiuenTsiang also noticed the presence of the Bael tree during his visit to India [13]. As per Hindu culture, the plant is considered as a sacred tree that is grown by the sides of Hindu temples as the plant is dedicated to Lord Shiva. The trifoliate leaves of the plant are used in the prayers of Lord Shiva and Parvati, hence the plant is also known by the name of Shivaduma. It is also believed that Lord Shiva resides under the Bael tree. Besides this, the plant carries great medicinal value and its medicinal description is also mentioned in the Vedas (Yajurveda), Puranas and has also been portrayed in the paintings of Ajanta Caves[14]. The Bael fruits were known since the Ramayana period and the tree was reported to be found in the Panchvati and Chitrakuta hills. The medicinal properties of the fruit of the Bael tree are also described in the ancient treatise BrihatSamhita and Charka Samhita[15]. As per ancient beliefs, the Bael tree acts as an indicator plant to trace the underground water. All the parts of the plant i.e. root leaf, trunk, seed and fruits carry various medicinal properties and are used to treat variety of diseases. The fruit of this plant is edible and is mostly used for medicinal purposes as it is a rich source of vitamins, minerals and antioxidants[16]

Botanical description of A. marmelos

Aeglemarmelos is a spinous, slow-growing, medium sized tree belonging to the family Rutaceae. The plant grows up to the height of 12-15 m and 90-120 cm in girth. The trunk is short, thick, soft, flaking bark with spreading spiny branches. Spikes present are long, sharp and axial[17]

Leaves

The leaves of A. marmelos are alternate, trifoliate, aromatic, deciduous borne as single or compound and comprises of 3 to 5 oval, pointed shallowly, thin toothed leaflets with length 4-10 cm and 2-5 cm in width, terminal one have long petiole while the lateral one is without a petiole. Leaves are composed of 3 to 5 leaflets. Leaf petiole is long and glabrous. Mature leaves possess a disagreeable odor when bruised,[18,19]

Flower

Flowers are fragrant, 2 cm wide, erect, stalked, sweet-scented and formed a cluster of about 4 to 7 flowers, 4 to 5 recurved fleshy petals, yellowish from inside and greenish from outside with 50 or more greenish stamens. The calyx is shallow with five short broad teeth, capitate stigma ovary is oblong-ovoid and has slightly tapering thick short style[20]

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Fruit

Fruits are round, aromatic, pale orange, fibrous oval, oblong, pyriform up to 5-20 cm in diameter and contain a hard, smoothwoody shell i.e. pericarp. In the early stages, the crust is graygreen which turns orange or yellowish when matured and becomes very hard and orange-red when dried. The hard central core with 8 to 20 indistinctly apparent triangular segments with thin dark orange walls is present inside the fruit. The pulp of the fruit is resinous, sweet, aromatic, pale-orange and astringent. Due to the slow ripening, the fruit can take 1 year for full ripening[21]

Seed Seeds are hairy, flattened-oblong shape, that varies from 10-50, embedded in the pulp of a fruit and germinate within 2-3 months. The seed encases in a sack of sticky transparent mucilage that solidifies after drying. Most of the seeds get aborted during the development process. The testa is white[22,23]

Nutritional Value

Nutritional Value of Bael plant is a rich source of proteins, carbohydrates, vitamins, and minerals. The Bael plant contains vitamins such as carotene, thiamin, riboflavin, and niacin and minerals like calcium, iron, phosphorus. Plant shows a variety of health benefits due to the presence of both macro and micronutrients such as vitamins, organic compounds including tannins, alkaloids, polyphenols, terpenes, fiber, protein, and oil. Bael pulp is a rich source vitamin C (ascorbic acid). The fruit pulp is blended with 30% sugar, and dehydrated powder is used for the preparation of cold drink or soft squash. Bael fruit is used for the preparation of toffee by combination of the pulp with sugar, glucose, skim milk powder, and hydrogenated fat. Bael fruit helps to destroy worms in the intestine and it is also recommended as a remedy for chronic dysentery. Fresh juice of leaves or flowers decreases the appetite while an infusion of the flowers mixed with sugar and milk is used as a cooling drink. Milk and sugar added to fruit juice make it more edible. The pulp of Baelfruit is used for making squash, nectar, jellies, marmalades, and candies. Mucilage from unripe seeds of Bael fruit is used as adhesive and glue. A gum-like thick substance collected from tree trunk and branches of Bael trees is used to make Feronia gum. The Bael dry powder is mixed with mustard oil in (1:2) used for the treatment of burn and applied externally. This is commonly used for curing of diarrhea and dysentery[24]

The Ethnomedicinal importance of *A. marmelos*[25]

This plant is used in traditional medicine treatments, such as intermittent fever, intestinal ailments, fertility control and treatment after childbirth and fish poison.British pharmacopoeia has included *A. marmelos* fruit because of its effectiveness against diarrhoea and dysentery [19]. Moreover, Chopra (1982) has appropriately stated that “No drug has been longer and better known, nor more appreciated by the inhabitants of India than the Bael fruit”

Marketed formulation of aegle marmelous.[26]

Marketed formulations	**Company Name**
Chyawanprash	Himalaya
AegleMarmelos Capsules	La-Medicca (India) Pvt. Limited
Leucare capsules	ShreyNutraceuticals& Herbals
Entrostat Syrup	Ambika Medico
Kof-Rid Syrup	Ambika Medico
Pregeigh	Sydler Remedies Pvt. Ltd.
Ojamin	Tates Remedies
Manasamithravatakram	Oushadhi
Pushyanugamgulika	Oushadhi
Vilwadigulika	Oushadhi
Glucomap	Maharishi Ayurveda
Ulco Bliss Tablets	Bliss ayurveda
Capsule BilvGiri	AyurvedicSanjivani
R-Qunol Syrup	VatsalAyurvedic Products (P) ltd

Chemical constituents of aegle marmelous[27]

: **Alkaloids**

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The alkaloids comprise the largest single class of secondary plant substances. New alkaloids from the leaves of A. marmelos were reported viz., halfordino, ethylcinnamamide, ethylcinnamamide, ethylcinnamamide and marmeline. Recently, series of phenylethylcinnamides, which included new compounds named anhydromarmeline, aegelinosides A and B were isolated from Aeglemarmelos leaves
as α-glucosidase inhibitors.

Phenylpropenoids

These are naturally occurring phenolic compounds, which have an aromatic ring to which three carbon side chain is attached. Among the phenylpropenoids are included hydroxylcoumarins, phenylpropenes and lignans These are naturally occurring phenolic compounds, which have an aromatic ring to which three carbon side chain is attached. Among thephenylpropenoids are included hydroxylcoumarins, phenylpropenes and lignans.

Terpenoids

The essential oil ofA. marmelos(L.) Correa leaves were studied very much extensively in India by various workers since 1950. α-Phellandrene was found to be the common constituent of the essential oil from leaves, twigs and fruits. α-Phellandrene (56%) and p-cymene (17%) were reported from leaf oil. Limonene (82.4%) was reported as the main constituent from A. marmelos leaves and it was shown that limonene is characteristic marker for identification of A. marmelo soil samples

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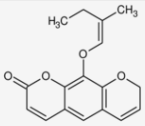
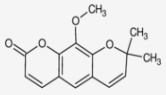
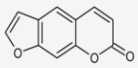
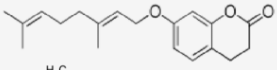
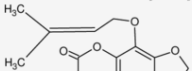
Tannins

The maximum tannin content in bael fruit was recorded in the month of January. There is as much as 9% tannin in the pulp of wild fruits, less in cultivated type. Tannin is also present in leaves as skimmianine, it is also named as 4, 7, 8-trimethoxyfuro, quinoline.

Bioactive compound of aeglemarmelous and its activity [28]

Chemical constituents	Pharmacological Activity	Structure
Marmelosin	Antihelmintic , Antibacterial	
Luvangetin	Antiulcer	
Tannin	Antidiarroheal, Astringent	Type not reported
Psoralen	Antispasmodic , Cytotoxic , Artimicide	
Aurapten	Heart beat inhibitor	
Marmelide	Antiviral	

Pharmacological activity of aeglemarmelous

Antioxidant activity

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The Methanolic and ethanolic extract of the fruit pulp of A. marmelos plant was tested for antioxidant activity in a rat model by DPPH radical scavenging method, nitric oxide scavenging assay, reducing power assay, H2O2 radical scavenging assay, ABTS radical scavenging assay and superoxide radical scavenging assay[29]. The free radical inhibition was observed by the Methanolic and ethanolic extract of the plant that showed good antioxidant activity of the plant. The inhibitory activity of the unripe fruit is more than the mature fruit[30].

Anti-diabetic activity

All extracts of A. marmelos leaves was investigated for hypoglycemic activity against various animal models. The aqueous and alcoholic extract of the fruit part showed hyperglycemia activity against rabbits at the dosage of 500 mg/kg body weight[31,32] The fruit extract of the plant showed protective effects on pancreatic tissues in diabetic rats[33]

Antifungal activity

The ethanolic extract of the root showed antifungal activity against A. fumigates and T. mentagrophytes84. The essential oil isolated from the leaves of the Bael plant showed antifungal activity against Trichophytonmentagrophytes, T. rubrum, Microsporumgypseum, Histoplasmacapsulatum, A. flavus, M. cookie and Aspergillus niger[34]

Anti-proliferative activity

The ethanolic extracts of the plant were reported to show antiproliferative effects against various human tumor cell lines. The cells are allowed to grow for 24 hours in a carbon dioxide incubator. The plant extract was added further after the complete growth of the cells and incubated for 48 hours. It was observed that the extract inhibits the in vitro proliferation of human tumor cell lines including the leukemic K562, T-lymphoid jurkat, BlymphoidRaji, erythroleukemic HEL, melanoma Colo 38 and breast cancer MCF and MDA-MB-231 cell lines.[35]

Cytoprotective activity

To identify the Cytoprotective activity of the A. marmelos plant, the study was carried in Cyprinuscarpio or freshwater fish. The experimental fish was provided with the sun-lethal concentration of metal ion for 1, 8, 16 and 32 days. Later, these fishes were fed with crude powder of the A. marmelos plant at a dosage of 500 mg/kg. Results showed the stabilization of plasma membrane and modulation of antioxidant enzymes system, thus showed cardioprotective activity[36]

Hepatoprotective activity

The alcoholic extract of the leaves of the A. marmelos plant was tested for the hepatoprotective activity against the albino rat model. Rats were injected (intra peritoneal route) with bacterial suspension at a dosage of 5*106 CFU/0.1 ml. Later, the animal model was treated with the alcoholic extract of the plant for 15 days. After that, the albino rat fasted for 12 hours and mild chloroform anesthesia was given to the model. 30% ethyl alcohol extract was administered to albino rats regularly for 40 days and then fed with the leaf powder of the plant for the next 21 days. The hepatoprotective effect of the A. marmelos leaf was observed in the experimental model [37]

Antifertility activity

The Methanolic extract of the leaves of A. marmelos plant was investigated for antifertility activity in the male rat model. It was found that the Methanolic extract at the dosage of 200, 400 and 600 mg/kg showed an abnormal reduction in the sperm count with the decrease in the motility of sperm and also affects the sexual behavior and epididymal sperm concentration[38.]

Anticancer activity

The plant extract was tested for the anticancer activity against tumor cell lines by using sea urchin egg assay, brine shrimp lethality assay and MTT assay method. The plant extract showed toxic effects against all the used assays[39]. Jagetia G.C. et al also reported that the hydro alcoholic extract of the leaves exhibits anticancer effects in the Ehrlich ascites carcinoma and proposed that the induction of apoptosis may be due to the presence of skimmianine in the plant extract[40]

Analgesic activity

The Methanolic extract of the leaves of the Bael plant was tested for analgesic activity using writhing and tail immersion test in the mice model at a dosage of 200 mg/kg. Results showed a significant analgesic activity of the plant[41]

Antiviral activity

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The hydro alcoholic extract of the fruit of the Bael plant showed significant antiviral activity when tested against Ranikhet disease virus[42]

Antiulcer activity

The polyherbal formulation prepared from the leaf part of A. marmelos, rhizome of Glycyrrhizaglabra (200 mg), the root part of Hemidesmusindicus and fruit part of Cuminumcyminum was investigated for antiulcer activity against ethanol-induced gastric ulcer model in Wistar rats. The oral administration of the polyherbal formulation at the dosage of 500 mg/kg produces moderate inhibition of gastric lesions in the rat model concerning the standard 20 mg/kg omeprazole administration. It was found that the polyherbal formulation can be useful to treat severe gastric ulcers and produces a non-toxic effect seven at high concentration[43.]

Immunosuppressant activity

The Methanolic extract of the fruit was investigated for the immunosuppressant activity against Wistar albino rats using carbon clearance assay and neutrophil adhesion test. It was found that the extract at the dosage of 500 mg/kg showed immunomodulatory activity against the rat model by increasing the production of neutrophil adhesion and phagocytic index in carbon clearance assay[44]

. **Wound healing activity**

The effect of Methanolic extract of the seed's ointment and injection of Bael plant was investigated against excision wound model in male Wistar rats. The ointment was applied over the wound till its complete healing and measured on 0, 4, 8, 12, 16 and 20 post wounding day[45.] Results showed a faster healing rate and showed a higher rate of contracting wounds when compared with the control sample. The increase in the tensile strength in the incision model showed the healing process of the plant extract[46]

Anti-arthritis activity

The Methanolic extract of the leaves of the Bael plant showed anti-arthritis activity against collagen-induced arthritis in Wistar albino rats. Significant reduction in the histopathological and radiological changes was observed in the experimental rat model after their treatment with Methanolic extract of the plant[47]

Contractile activity

The alcoholic extract of the leaves of the Bael plant was tested for the contractile activity against guinea pig isolated ileum and tracheal chain because of its use in treating asthma and related disorders. It was observed that the alcoholic extract at dosages of 1 mg/ml and 2 mg/ml showed significant relaxation of guinea pig ileum and tracheal chain because of the depression of H1 receptors [48]

Radio-protective activity

The hydro alcoholic extract of the fruit of the Bael plant was evaluated for the radio-protective activity against Swiss albino mice model that was exposed to several doses of gamma radiation. The extract was administered through intra-peritoneal route for 5 days at the dosage of 5, 10, 15, 20 and 40 mg/kg before exposure to 10 Gy 60 Co gamma-radiations. The maximum ShailjaChoudhary et al / Int. J. Res. Ayurveda Pharm. 12 (3), 2021 153 protection was reported after the 30 days of post-radiation and it was also observed that 15 mg/kg dosage of the extract produces the highest survival rate[49]

Antidepressant and anxiolytic activity

The Methanolic extract of the leaves of Bael plant showed antidepressant and anxiolytic activity against the mice model [50]

Anti-stress and adaptogenic activity

The aqueous extract of the plant was studied for anti-stress and adaptogenic activity against albino rats of either sex using Swimming endurance or post-swimming motor function test, swimming endurance test and forced swim test. The extract when subjected to a forced swim model for adaptogenic activity, it failed to show an increase in serum cholesterol and serum triglyceride level but the increase was not sustained on subsequent groups. Also, the extract enhances the swimming endurance time and could also restrict the increase in the level of these markers during stress[51]

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II. CONCLUSION

From this review, Aeglemarmelos is an important medicinal herb and extensively used in Ayurveda, Siddha and other medicinal systems. The different parts of this plant such as leaf, fruit, seed, bark and root are used to cure a variety of diseases. The A. marmelos contains Antioxidant, Antibacterial, Antifungal, Antidiarrheal, Antidiabetic, Cytoprotective, Hepatoprotective, Antifertility, Anticancer, Antiviral and Wound Healing properties. Number of biologically active compounds are isolated from various parts of A. marmelos. The isolated compounds are Alkaloids, Terpenoids, Vitamins, Coumarins, Tannins, Carbohydrates, Flavonoids, Fatty Acids, Essential Oils and some other miscellaneous compounds.

Traditional system of medicine continues to be widely practised for various reasons. Fast populations, inadequate supply of medicines, side effects of several allopathic drugs and ever increasing resistance to current drugs for diseases have led to growing emphasis on the use of plant materials as a source of medicines for human beings. It is strongly believed that detailed information as presented in this review on the phytochemicals and various biological properties of the plant extracts might provide detailed evidence for the use of this plant in different medicines. Historically, Aegle marmelos(Bael) has been used for the number of ethnobotanical purposes. At presentAeglemarmelos has become an important source of medicine for curing various human and animal diseases.

REFERENCES

[1]. Parmar C and Kaushal MK, Aeglemarmelos. In: Wild Fruits, Kalyani Publishers, New Delhi, India. 1982, 1–5.

[2]. Shoeb M. Anti-cancer agents from medicinal plants. Bangladesh journal of Pharmacology. 2006;1(2):35-41.

[3]. 3Sekar DK, Kumar G, Karthik L, Rao KB. A review on pharmacological and phytochemical properties of Aeglemarmelos (L.) Corr. Serr. (Rutaceae). Asian Journal of Plant Science and Research. 2011;1(2):8-17.

[4]. .Bhar K, Mondal S, Suresh P. An eye-catching review of Aeglemarmelos L. (Golden Apple). Pharmacognosy Journal. 2019;11(2): 207-224

[5]. Purohit SS and Vyas SP, In: Aeglemarmelos Correa ex Roxb. (Bael), Medicinal plant Cultivation- A Scientific Approach, Agrobios, Jodhpur,2004, pp.280-285

[6]. . Dhankhar S, Ruhil S, Balhara M, Dhankhar S, Chhillar AK. Aeglemarmelos (Linn.) Correa: A potential source of Phytomedicine. J Med Plant Res. 2011 May 4;5(9):1497-507.

[7]. Dhankher S. AegleMarmelos (Linn.) Correa: A source of phytomedicine. Jmedi plants Res, 2010;5(9):197-1507

[8]. PatkarAtul N, Desai Nilesh V, a review of AegleMarmelos: a potential medicine, international research journal of pharmacy, ISSN 2230-8407.

[9]. . Pushpendra K. Patel, AegleMarmelos: A Review on its Medicinal Properties, International Journal of Pharmaceutical and Phytopharmacological Research.

[10]. Dinesh Kumar Sekar, A review on pharmacological and phytochemical properties of AegleMarmelos(L.) Corr. KumariAnupama et al: Bilwa (AegleMarmelos) - A Review Article IAMJ: Volume 8, Issue 2, February - 2020 (www.iamj.in) Page 2796 Serr. (Rutaceae), Asian Journal of plant and research, 2011, 1 (2):8-17

[11]. Kintzios SE. Terrestrial plant-derived anticancer agents and plant species used in anticancer research. Critical reviews in plant sciences 2006 May ; 25(2): 79-113.

[12]. . Neeraj VB, Johar V. Bael (Aeglemarmelos) extraordinary species of India: a review. Int. J. Curr. Microbiol. Appl. Sci 2017; 6(3): 1870-87.

[13]. Sharma N, Dubey W. History and taxonomy of Aeglemarmelos: a review. International Journal of Pure and Applied Bioscience 2013; 1(6): 7-13

[14]. . . Om P. Food and Drinks in Ancient India, from Earliest Times to c. 1200 ad.1961; 26(1): 198-199.

[15]. . Śārṅgadhara, Majumdar GP. Upavana-vinoda: A Sanskrit treatise on arbori-horticulture. Indian Research Institute; 1935.

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[16]. . Ghosh S, Kumar A, Sachan N, Chandra P. Bioactive Compounds and Distinctive Pharmacological Activity Guided Review of Aeglemarmelos: A Miraculous Plant of Indigenous Medicine System. Current Bioactive Compounds 2020 Oct 1; 16(7): 965-77.

[17]. Sekar DK, Kumar G, Karthik L, Rao KB. A review on pharmacological and phytochemical properties of Aeglemarmelos (L.) Corr. Serr. (Rutaceae). Asian Journal of Plant Science and Research 2011; 1(2): 8-17

[18]. . . Ajithkumar D, Seeni S. Rapid clonal multiplication through in vitro axillary shoots proliferation of Aeglemarmelos (L.) Corr., a medicinal tree. Plant Cell Reports 1998 Mar; 17(5): 422-6

[19]. . Das SK, Roy C. The protective role of Aeglemarmelos on aspirin–induced gastro-duodenal ulceration in albino rat model: a possible involvement of antioxidants. Saudi Journal of gastroenterology: official journal of the Saudi Gastroenterology Association 2012 May; 18(3): 188. 27. Mali SS, Dhumal RL, Havaldar VD, Shinde SS

[20]. Mali SS, Dhumal RL, Havaldar VD, Shinde SS, Jadhav NY, Gaikwad BS. A systematic review on Aeglemarmelos (Bael). Research Journal of Pharmacognosy and Phytochemistry 2020; 12(1): 31-6.

[21]. . Swingle WT. botany of citrus and its wild relatives of the orange subfamily (family Rutaceae, subfamily Aurantioideae); 1943. p. 1.

[22]. Cottin R. Citrus of the World. A Citrus Directory Version 2. SRA INRA-CIRAD, France; 2002. 30. Bayer RJ, Mabberley DJ, Morton C, Miller CH, Sharma IK, Pfeil BE, Rich S, Hitchcock R, Sykes S. A molecular phylogeny of the orange subfamily (Rutaceae: Aurantioideae) using nine cpDNA sequences. American Journal of Botany 2009 Mar; 96(3): 668-85

[23]. Nagar S, Kumar M, Kumatkar RB, Sharma JR, Sing S. Evaluation of Bael (Aeglemarmelos Corr.) germ plasms for seed and qualitative characters under semi-arid conditions of Haryana. International Journal of Pure & Applied Bioscience 20

[24]. Upadhyay RK. Bel plant: A source of pharmaceuticals and ethno medicines. International Journal of Green Pharmacy (IJGP). 2015 Dec 14;9(4). 11. Kirtikar KR, Basu BD. Indian medicinal plants. Indian M

[25]. Basu Da, Sen R (1974). Alkaloids and coumarins from root bark of *Aeglemarmelos*. *Phytochemistry*, 13: 2329-233

[26]. Sharma P K, Bhatia v Bansal Nand Sharma International journalJournal of life Scientific Research A.A review on bael tree . Natural prtoduct Radiance volume -1 Issue -1 .pp-5-7

[27]. Yadav NP, Chanotia CS. Phytochemical and pharmacological profile of leaves of Aeglemarmelos Linn. The pharma Review 2009:144-9

[28]. Laphookhieo S, Phungpanya C, Tantapakul C, Techa S, Tha-in S, Narmddorkmai W: Chemical constituents from Aeglemarmelos. J. Braz. Chem. Soc 2010; 00(00); 1-3.

[29]. . Rajan S, Gokila M, Jency P, Brindha P, Sujatha RK. Antioxidant and phytochemical properties of Aeglemarmelos fruit pulp. Int J Curr Pharm Res 2011; 3(2): 65- 70.

[30]. . Kaur C, Kapoor HC. Antioxidant activity of some fruits in Indian diet. In VII International Symposium on Temperate Zone Fruits in the Tropics and Subtropics-Part Two 696; 2003 Oct 14. p. 563-565

[31]. . Anandharajan R, Jaiganesh S, Shankernarayanan NP, Viswakarma RA, Balakrishnan A. In vitro glucose uptake activity of Aeglemarmelos and Syzygiumcumini by activation of Glut-4, PI3 kinase and PPARγ in L6 myotubes. Phytomedicine 2006 Jun 12; 13(6): 434-41.

[32]. Kamalakkannan N, StanelyMainzen Prince P. Anti hyperlipidaemic effect of Aeglemarmelos fruit extract in streptozotocin-induced diabetes in rats. Journal of the Science of Food and Agriculture 2005 Mar; 85(4): 569-73. 88.

[33]. Hema CG, Lalithakumari K. Screening of pharmacological actions of Aeglemarmelos. Indian Journal of Pharmacology 1988 Apr 1; 20(2): 80.

[34]. Jain NK. Antifungal activity of essential oil of Aeglemarmelos Correa (Rutaceae). Ind Drugs PharmaceutInd 1977; 12: 55

[35]. Lampronti I, Martello D, Bianchi N, Borgatti M, Lambertini E, Piva R, Jabbar S, Choudhuri MS, Khan MT, Gambari R. In vitro anti proliferative effects on human tumor cell lines of extracts from the Bangladeshi medicinal plant Aeglemarmelos Correa. Phytomedicine 2003 Jan 1; 10(4): 300-8

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[36]. Vinodhini R, Narayanan M. Cytoprotective effect of Nelumbonucifera and Aeglemarmelos in Common Carp (Cyprinuscarpio L.) exposed to heavy metals. International journal of Integrative biology 2009; 7(2): 124-9.

[37]. Singanan V, Singanan M, Begum H. The hepatoprotective effect of Bael leaves (Aeglemarmelos) in alcohol induced liver injury in albino rats. International Journal of Science & Technology 2007; 2(2): 83-92.

[38]. . Sathiyaraj K, Sivaraj A, Madhumitha G, Kumar PV, Saral AM, Devi K, Kumar BS. Antifertility effect of aqueous leaf extract of Aeglemarmelos on male albino rats. Int J CurrPharmaceu Res 2010; 2: 26-9

[39]. Jagetia GC, Venkatesh P, Baliga MS. Aeglemarmelos (L.) Correa Inhibits the Proliferation of Transplanted Ehrlich Ascites Carcinoma in Mice. Biological and Pharmaceutical Bulletin 2005; 28(1): 58-64.

[40]. Costa-Lotufo LV, Khan MT, Ather A, Wilke DV, Jimenez PC, Pessoa C, de Moraes ME, de Moraes MO. Studies of the anticancer potential of plants used in Bangladeshi folk medicine. Journal of Ethnopharmacology 2005 May 13; 99(1): 21-30

[41]. Shankarananth V, Balakrishnan N, Suresh D, Sureshpandian G, Edwin E, Sheeja E. Analgesic activity of methanol extract of Aeglemarmelos leaves. Fitoterapia 2007 Apr 1; 78(3): 258-9

[42]. Gupta D, John PP, Pankaj K, Kaushik R, Yadav R. Pharmacological review of Aeglemarmelos corr. Fruits. International Journal of Pharmaceutical Sciences and Research 2011 Aug 1; 2(8): 2031.

[43]. Shanthi A, Radha R, Jaysree N. Anti-ulcer activity of newly formulated herbal capsule. Asian J Pharm Clin Res 2011; 4(3): 86-9

[44]. Shivhare Y, Singour PK, Patil UK, Pawar RS. Wound healing potential of Methanolic extract of TrichosanthesdioicaRoxb (fruits) in rats. Journal of ethnopharmacology 2010 Feb 17; 127(3): 614-9

[45]. Pattanayak SP, Sunita P. Wound healing, anti-microbial and antioxidant potential of Dendrophthoefalcata (Lf) Ettingsh. Journal of ethnopharmacology 2008 Nov 20; 120(2): 241-7

[46]. Lee KH. Studies on the mechanism of action of salicylates III. Effect of vitamin A on the wound healing retardation action of aspirin. Journal of Pharmaceutical Sciences 1968 Jul; 57(7): 1238-40.

[47]. Arul V, Miyazaki S, Dhananjayan R. Mechanisms of the contractile effect of the alcoholic extract of Aeglemarmelos Corr. on isolated guinea pig ileum and tracheal chain. Phytomedicine 2004 Nov 25; 11(7-8): 679-83.

[48]. Shivhare Y, Singour PK, Patil UK, Pawar RS. Wound healing potential of Methanolic extract of TrichosanthesdioicaRoxb (fruits) in rats. Journal of ethnopharmacology 2010 Feb 17; 127(3): 614

[49]. Jagetia GC, Venkatesh P, Baliga MS. Evaluation of the radio-protective effect of Aeglemarmelos (L.) Correa in cultured human peripheral blood lymphocytes exposed to different doses of γ-radiation: a micronucleus study. Mutagenesis 2003 Jul 1; 18(4): 387-93

[50]. Kothari S, Minda M, Tonpay SD. Anxiolytic and antidepressant activities of methanol extract of Aeglemarmelos leaves in mice. Indian J PhysiolPharmacol 2010 Oct 1; 54(4): 318-28

[51]. Duraisami R, Mohite VA, Kasbe AJ. Anti-stress, adaptogenic activity of standardized dried fruit extract of Aeglemarmelos against diverse stressors. Asian J Pharm Clin Res 2010; 3(4): 1-3.