

PHYTOCHEMICAL AND PHARMACOLOGICAL PROFILE OF *EMBLICA OFFICINALIS* LINN**Deshmukh Chinmay Devidas*, Choudhari Shradha Pramod****Dr. Vishwanath Karad MIT World Peace University, Pune, Maharashtra, INDIA****ABSTRACT**

Emblica officinalis (EO) (Family: Euphorbiaceae), commonly called Amla, is a traditional plant, occurring commonly in deciduous forests in India and widely used globally for the management of various ailments. When its phytochemistry is studied in detail, it reveals the presence of vitamin C, ellagic acid, gallic acid, phyllembin, tannin, phyllemblic acid, lipids and emblicol. The fruit of this plant is commonly used for a cooling, diuretic, laxative activity. It is also used for the treatment of anemia, jaundice and dyspepsia. The seeds are used for the management of different respiratory tract disorders such as bronchitis, asthma, and digestive problems. Various scientists and researchers have isolated the parts of this plant for studying its pharmacological activities and therapeutic approaches. They have explored this plant for its hepatoprotective, gastroprotective, cytoprotective, antitumor, antifungal and antiulcer activity. Further, this plant is also claimed to have other beneficial effects in Ayurveda and traditional medicines. This plant is common and widely available. It is consumed by various Indian people routinely. It is important ingredient of cosmetics, shampoos, hair oils, dyes and famous health tonic Chyavanprash. Though, various literature is available on this plant and fruit but due to interest and curiosity to further explore the information of its uses, chemical composition, pharmacological activities of extract and its isolated compounds and safety profile, the present review paper is planned. This information will be useful for further research of this plant.

Keywords: *Emblica officinalis*, euphorbiaceae, vitamin C, emblicol, cytoprotective, dyspepsia**Duration: Received-** 12/04/2021, **Reviewed-** 18/04/2021, **Revised/ Accepted-** 25/04/2021**Correspondence****Deshmukh Chinmay Devidas*** ✉ deshchin2253@gmail.com**Address -** Department of Pharmacology, School of Pharmacy, Dr. Vishwanath Karad MIT World Peace University, Pune, Maharashtra- 411038, India.**INTRODUCTION**

Maximum number of the people are depending on herbal traditional medicines for their fundamental healthcare needs as per the WHO (World Health Organization).^[1] India is having the treasure of it. *Emblica officinalis* (EO), family Euphorbiaceae is one of the herbal plants commonly utilized in many of the therapeutic preparations for variety of disorders. It is commonly called Indian gooseberry or Amla. The health tonic, Chyavanprash contains EO.^[2] The fruits are cooling, acrid, diuretic and refrigerant they are also useful in dysentery, hemorrhage and diarrhea. Amla fruits are antibacterial, anabolic, and possess expectorant, antimicrobial, hepatoprotective, adaptogenic, antiulcerogenic, cardiogenic, antipyretic, antioxidant, antiviral and antiemetic activities.^[3, 4] This plant is commonly available in Indian market. It is routinely consumed by Indians. The Amla fruit is important ingredient of various edible and non-edible preparations. The dried spicy chewable tablet is used for proper digestion among the people. In summer, various people

also prepare Amla drink, Amla candy, and it is liked by childrens also. Traditionally it is claimed to have variety of beneficial effects. In Ayurveda, it is ingredient of various medicines. This plant is also prescribed for vitamin C deficiency. Amla pickle is also very popular. Recently it is reported that fresh juice of EO possesses antiulcerogenic activity. Further, it is investigated that the methanolic extract possesses significant antioxidant activity.^[5]

Though much of the literature is available on this plant; the present review focuses on the updated information of phytochemistry, pharmacognosy, and certain therapeutic activities of this plant in preceding sections of this paper.

BOTANICAL DESCRIPTION**Taxonomy**

- Name in botany: *Phyllanthus Emblica* (Linn.)
- Common name : Indian gooseberry, *Emblin Myrobalan*, Amla
- Family: Euphorbiaceae.
- Similar names: Emblica, Indian goose berry, amla

- Kingdom: Plantae-Plants
- Division: Magnoliophyta- Flowering plant
- Superdivision: Spermatophyta- Seed plant
- Order: Euphorbiales
- Genus: Phyllanthus-Leafflower
- Species: *Emblica officinalis*
- Subclass: Rosidae
- Subkingdom: Tracheobionta

Vernacular names

- Sanskrit: Adiphala, Dhatri, Amalaka
- Urdu: Anwala
- Assamese: Amlaki
- Hindi: Amla, Amlika, Aonla
- Punjabi: Ambli
- Marathi: Aola
- Tamil: Nelli
- Gujarathi: Amali, Ambala
- Telugu: Amalakamu, Usirikai
- Bengali: Amla, Amlaki
- Kannada: Amalaka, Nelli
- Malayalam: Nelli

Synonyms

- Indian gooseberry
- Amla
- Amlaki
- *Emblica*
- *Myrobalan*

MORPHOLOGICAL CHARACTERS

It is deciduous medium-sized tree with branches.

- Leaves- leaves are simple, 10-13 mm long, stipulate, linear, feathery, 2-3 mm broad, with very small narrowly oblong, pinnately arranged leaflets.
- Flowers - very small, unisexual, 0.5 to 1.5 cm across, greenish-yellow.
- Fruits – fruits are nearly globular or spherical slightly broader than long, and with a shallow, small, conical depression at longitudinal axis, mainly at that point where stalk attached, in different sizes. They are marked with six lobes, pale green or yellowish color, 1.5-2.5 cm in diameter. Matured fruits have yellowish-brown endocarp and also yellow mesocarp. The mesocarp in it is acidulous and astringent in dried fruits and acidulous in fresh fruits.
- Seeds- Trigonous, two each in three crustaceous cocci. [6-9]

MACROSCOPIC CHARACTERS

Color- Green. But when matures, it becomes light yellow or brick red.

Odor- Almost none

Taste- Astringent and Sore

Size- Diameter is 1.5-2.5 cm

Shape- Fruits are globose and depressed. [10]

OCCURRENCE AND DISTRIBUTION

Almost all deciduous forest of India, this plant is available. It is also found in Burma Sri Lanka, and Myanmar. It is also distributed in Madagascar and East Asia. It is commonly occurring in Chhintipur of Chhindwara district, Madhya Pradesh

CULTIVATION AND COLLECTION

Seed germination is basic process to grow this plant. Budding and cutting are important steps to propagate this plant. Frost or drought can damage this plant. It grows at a height of approximately 1500 m. The plants which are grown wild, is the main source of its collection. The red loamy or coarse gravelly soil is required for its plantation. Irrigation is most important specially drip irrigation. Fertilizers such as 750-1000 gm or urea, 1 kg of superphosphate and 1-2 kg of potash per annum are required depending on soil quality. These fertilizer doses are given two times a year equally. First September/October and other April/May. Male and female flowers are grown on plant. Male flowers are found in bunches and in axil of the leaf, whereas female flowers in the axil of the branches and are alone. 25-30% of flowers is the extent of fertilization. Large fruit are found on cultivated plant. About 175-300 kg fruits are collected from healthy plant. Pectin is found most commonly and in abundant amount in fruit. Similarly, vitamin C is richest content of Amla fruit. Amla fruit juice contains nearly 20 times more than that of orange juice. [10]

CHEMICAL CONSTITUENTS

As discussed above, vitamin C is present in Amla fruit. Vitamin C is obtained from fruit either in concentrate form or crystalline form. Dried Amla powder is used for extraction of Vitamin C by alcohol. This is then adsorbed on magnesia and eluted with water and saturated with hydrogen sulphide. The concentrated elutriate is made in bulk under vacuum and further extracted with mixture of acetone, methanol and anhydrous ether. Vitamin C crystals are separated from the solvent extract and yield is approximately 1000 mg per 100 cc. Amla fruit also contains phyllembin, gallic acid 5% and phyllembic acid 6.3%, 5% tannin, lipids 6 %, and emblicol. Mucic acid can be isolated from crystalline vitamin C. Phyllembin from the fruit pulp is known as ethyl gallate. The bark contains a chemical constituent called leukodelphinidin. The gallic acid, ellagic acid and glucose are present as tannins in its molecule and fruit are responsible for preventing and retarding the vitamin C oxidation. Thus, fruit is valuable vitamin C source in fresh, dry condition. [09,10]. Amla fruits are also rich in a mineral matter like phosphorus, iron and calcium. It contains an appreciable

amount of pectin. The fixed oil, phosphatides and essential oil is present in seeds, and therefore, it has characteristic odor. The fixed oil whose yield is about 16% has brownish yellow color and reported to have following properties. These properties are physical and chemical. The components of oil are linoleic (44.0%), palmitic (2.99%) oleic (28.40%), linolenic (8.78%), myristic acid (0.95), stearic (2.15%), and Proteolytic and lipolytic enzymes are present in the seeds. Tannins are present in leaf and bark. Fruits contain stem bark 8-9%, twig bark 21%, and leave contain 22% tannins. ^[11]

THERAPEUTIC USES

The fruits are utilized for preparing hair ois, shampoos, inks and hair dyes. The dried fruits are detergent. The fixed oil present in fruit is also essential for hair growth. The fruit is also consumed in raw. The fruit is also important ingredient for jams, jellies, pickles and various Amla products. It is a very popular ingredient of 'Triphala' and 'Chyavanprash'. It is also believed to delay the aging process and continue young age. For the fodder for cattle, the leaves and fruits are used. When used with iron mordant, the leaves contain a brownish-yellow coloring matter used in dyeing mulberry silks, wool and tusser. In Mysore, the leaves are used as cardamom plantations and manure in areca. For ameliorating alkali soils, leaves can be used. The wood is hard and close-grained, red and it is liable to split. It is used for construction of poles, agricultural implements, in building and in furniture work. It is also durable under the water and suited for construction of well, it is also used for making charcoal as a fuel. ^[10-12]

PHARMACOLOGICAL PROFILE OF DRUG

Ulcer protective and healing activity: Pepticare (*Glycyrrhiza galabra*, *Emblica officinalis* and *Tinospora cordifolia*) in 250, 125, 500 and 100 mg per kg doses, p.o was found to reduce ulcer index and volume and total acidity in pylorus-ligated and gastric mucosal injury (ethanol-induced) in rats. ^[13]

Inhibition of lipid peroxidation: Methanolic extract of *Emblica officinalis*, with 10, 12 and 13 µg/ml IC₅₀ values showed an inhibitory effect on lipid peroxidation using bovine brain phospholipids liposomes. ^[14] In another study, Triphala's extract in methanol (Triphala is prepared by mixing suitable amount of *Emblica officinalis*, *Terminalia chebula* and *Terminalia bellerica*) (100 mg per kg) were seen to inhibit formation of lipid peroxide as well as scavenge hydroxyl radicals and superoxide radicals in vitro. Extracts in 100 milligram per kilogram body weight dose also dropped the glucose level in blood in alloxan (120 mg per kg) induced rats, having diabetes and in normal in period of 4 hours on oral administration. ^[15]

Antioxidant, cytoprotective and immunomodulating activity: *Emblica officinalis*'s fruit extract in ethanol possess antioxidant, immunomodulating and cytoprotective properties using immunosuppressive agent such as chromium (Cr). free radical production induced by Cr is significantly dropped and restored the antioxidant status as compared to control levels using Amla. ^[16] In another study, the amla fruits are antioxidant and this property is due to the presence of a large quantity of ascorbic acid in the fruit as determined by the HPLC method using diode array. The antioxidant effect has also been evaluated by various antioxidant tests by comparing to the real levels of vitamin C. ^[17]

In another study, tannoid in fruit of *Emblica officinalis* also possess activity against oxidation in vivo and in vitro. In this study, emblicanin-A and emblicanin-B from the *Emblica officinalis* fruit's fresh juice was examined for antioxidant property against oxidative stress which was induced by ischemia reperfusion method in rat heart. ^[18] In another study, dried fruit of *Amla* was extracted first with methyl alcohol and then later partitioned by ethyl acetate, ethyl ether, water and butanol. The separation and purification fraction of ethyl acetate was performed using Sephadex LH-20 technique of chromatography and high-performance reverse-phase liquid technique chromatography. Compounds namely quercetin, kaempferol, geraniin, quercetin and isocrocin were identified. All the compounds which were purified showed strong radical scavenging and antioxidant activities. ^[19] In another study, the activity against oxidation of phenolics (both free and bound) of *Emblica officinalis* was investigated. The phenol present in *E. officinalis* is related with maximum antioxidant activity in *E. officinalis*. Tannic and gallic acid of *E. officinalis* were separated and identified in phenolic fractions as major antioxidant components. ^[20]

Anti-tumor activity: *Emblica officinalis* aqueous extract in 250, 500 mg and 1.25 g per kg body weight doses and Chyavanprash in 500 mg and 2.5 gram per kilogram body weight doses reduced the tumors in mice induced by Daltons lymphoma ascites cells. ^[21]

Cough suppression activity: Dried, crushed, powdered and soaked fruits of *Emblica officinalis*, in 50 and 200 mg/kg body weight doses, orally, suppress cough induced by stimulation of the airway's tracheobronchial mucous area and laryngopharyngeal areas in conscious cats. ^[22]

Antisnake venom activity: The *Emblica officinalis* root extract in methanol and *Vitex negundo* Gaertn were studied for antisnake venom activity for the first time. This plant extracts significantly antagonized lethal activity induced by *Naja kaouthia* and *Vipera russellii* venom in both in vitro and in vivo studies. ^[23]

Hypolipidemic and antiatherosclerotic activity: Lipid-lowering activity and antiatherosclerotic property of fresh juice of *Emblica officinalis* were examined in rabbits fed with cholesterol in 5 ml per kg body weight dose of rabbit/day for about 60 days. [24] In another study, flavonoids present in *Mangifera indica* and *Emblica officinalis* significantly reduces lipid levels in tissues and serum of rats that has been induced hyperlipidemia. The inhibition of β -Hydroxy β -methylglutaryl-CoA (*HMG-CoA*) reductase activity of liver was also observed in rats which were fed with *E. officinalis* flavonoids. [25]

Anti-radiation activity: The *Triphala* was administered by intraperitoneal route in mice in a doses of 5, 6.25, 10, 12.5, 20, 25, 40, 50 and 80 mg/kg body to study mortality in mice induced by radiation that has exposed to of gamma radiation. It was observed that there was delay in the mortality onset and reduction in the clinical features of radiation sickness in mice that have been treated with various doses of *Triphala* continuously for 5 days when comparison made with the non-drug treated irradiated controls. [26]

Maintaining homeostasis and increasing resistance: For maintaining physique, vitality and vigor and for delaying aging process, *Chyavanprash* has been used traditionally. It is believed that *Chyavanprash* helps not only in increasing the resistance of the body but also maintaining the homeostasis of the body. [27]

Lowering of serum enzymes: The levels of Serum transaminases induced by ethanol (AST and ALT) and IL-1 beta lowered with the advance treatment of rats with *Emblica officinalis* by 50, 25 and 75 mg per kg body weight with oral dose. [28]

Inhibition of hepatotoxicity: *Chyavanprash* (1 g/kg) and *Emblica officinalis* (500 mg per kg body weight) extracts were inhibiting hepatotoxicity induced by carbon tetrachloride in rats. This is confirmed by dropping levels of glutamate-pyruvate transaminase (GPT), serum and liver lipid peroxides (LPO), and alkaline phosphatase (ALP). [29]

Inhibition of hyperthermia and writhing: Aqueous extract of *Emblica officinalis* (500 milligrams per kilograms body weight, i.p) and a single oral dose of ethyl alcohol showed a effective reduction in Brewer's yeast induced hyperthermia in rats. Both drugs showed satisfactory reduction of writhing response induced by acetic acid in mice in the analgesic test. [30]

Antibacterial activity: For determining the activity against bacteria using Agar well diffusion method, hexane, aqueous, and alcoholic extract of *Emblica officinalis* were used at a sample concentration of 200 mg per ml. It was found that aqueous and hexane extract

showed lower activity as compared to alcoholic extract in their equal corresponding concentration. [31]

Anti-inflammatory activity: It is also found that, *P. aeruginosa*-dependent expression of pro-inflammatory genes is also inhibited by Pyrogallol. This Pyrogallol is a component extracted from *Emblica officinalis*. This result confirms that Pyrogallol is very effective compound for having activity against inflammation of *Emblica officinalis*. [32]

Antimicrobial activity: The activity against microbes of *Emblica officinalis* were also examined using two different methods (agar dilution and disc diffusion) using *Staphylococcus aureus*. [33]

Radical scavenging activities: The compounds isolated from *Emblica* fruit namely hydroxymethylfurfural, quercetin, gallic acid, ellagic acid, cinnamic acid, using mass spectrometry and NMR spectroscopy were found to possess 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activities except for cinnamic acid. [34]

Anti-hepatocarcinogenic activity: *Emblica officinalis* reduces the carcinogenic response in another experiment. In that, it reduces the gamma-GT positive foci number which is induced by Solt Farber protocol in the liver of Wistar rats and therefore reverses the histopathological changes. Tumors were induced by diethylnitrosoamine (DEN) (200 mg per kilogram of body weight by intraperitoneal route) followed by promotion with 2-acetylaminofluorene (2-AAF) (0.02% w/w in diet) for consecutive 6 weeks and the animals were undergone partial hepatectomy (removing liver part) twenty first day of initiation of experiment. Advance treatment with *Emblica officinalis* defatted methanolic fruit extract in a doses of 100 and 200 milligrams per kilograms body weight showed satisfactory partial recovery of pathological changes as compared to DEN and 2-PAF-treated animals and also it reduced tumor-forming capacity of 2-AAF at both the doses. [35]

Memory elevating activity: The effect of *Amla churna* (*Emblica officinalis*), an Ayurvedic drug was investigated on total cholesterol levels in serum and on memory to determine cholinesterase activity of brain. In this study, *Amla churna* was given orally in three doses (50,100 and 200 mg per kg) for consecutive 15 days to various groups of young and aged mice. For testing memory, passive avoidance apparatus and elevated plus maze are utilized as exteroceptive behavioral model. Aging-induced amnesia scopolamine and diazepam, worked as the interoceptive behavioral models. The cholinesterase activity of brain and total cholesterol levels in serum were estimated. *Amla churna*, at above doses produced a improvement in memory scores of young and aged mice in dose dependent manner. It was observed

finally that scopolamine (0.4 mg/kg, i.p.) induced amnesia and diazepam (1 mg/kg, i.p.) induced amnesia was reversed. The total cholesterol and the cholinesterase activity in brain were reduced by *Anwala churana* administered orally for 15 days.^[36]

CONCLUSION

From this paper and previous reports and literature, it is confirmed that *Emblica officinalis* has tremendous biological potential and can be successfully used for the treatment and management of variety of ailments. The results for these studies are so much satisfactory and therefore this plant is considered in the Ayurvedic and Chinese medicines. However, there is a need for further standardization and isolation of its active constituent because there is tremendous scope for further research. This drug can be used as a precursor or as an active ingredient for the preparation of various medicines in the pharmaceutical industry. This review therefore will provide satisfactory and effective evidence for its use in preparation of different medicines.

CONFLICT OF INTEREST

The authors declare that there is no any conflict of interest in the publication of this paper.

ACKNOWLEDGEMENT

The authors are extremely thankful to management, Dr. Vishwanath Karad MIT World Peace University, Dean & HoS, school of pharmacy, and Head, Department of Pharmacology for providing all necessary facilities in the publication of this paper. The authors are also thankful to various sources of internet, google and various newspapers, magazines for giving fruitful information for publication of this paper.

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How to cite this article

Deshmukh Chinmay Devidas*, Choudhari Shradha Pramod, 2021. Phytochemical And Pharmacological Profile Of *Emblica Officinalis* Linn. Jour. of Med. P'ceutical & Alli. Sci. V 10 - I 2, 1054. P-2698-2703. DOI: 10.22270/jmpas.V10I2.1054.