INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Review Article

A Review on The Species: *Phyllanthus emblica* L.

Dr. N. Astalakshmi*, Deena Dhayalan K, Dhinagaran P, Muthumani V, Sugandhan G, Suguna V, Dr. M. Surendra Kumar

Senghundhar College of Pharmacy, Kumaramangalam, Tiruchengode, Tamil Nadu, India.

ARTICLE INFO

Published: 12 Aug 2026
Keywords:
Phyllanthus emblica, Amla, Phytochemistry, Antimicrobial activity, Oral health, Herbal formulation
DOI:
10.5281/zenodo.21927094

ABSTRACT

Phyllanthus emblica Linn. (Amla, Indian gooseberry), a member of the family Phyllanthaceae, is a widely used medicinal plant with extensive application in traditional and modern oral healthcare due to its rich phytochemical composition, including tannins, gallic acid, ellagic acid, emblicanin A and B, flavonoids, and vitamin C. This literature review compiles and critically examines recent studies on the phytochemical profile and biological activities of different parts of P. emblica fruit, seed, bark, and leaf with particular emphasis on its antimicrobial, antibiofilm, anti-inflammatory, and periodontal therapeutic potential. Reported investigations demonstrate significant efficacy of P. emblica extracts and formulations, including endodontic irrigants, mouthwashes, and lollipop-based delivery systems, against key oral pathogens such as Streptococcus mutans, Enterococcus faecalis, and Pseudomonas aeruginosa, often comparable or superior to standard agents like chlorhexidine and sodium hypochlorite. The plant is also a principal constituent of Triphala, a polyherbal formulation extensively validated in clinical trials for plaque control, gingivitis management, and periodontal therapy. Additionally, quorum-sensing inhibition and biofilm suppression studies highlight its emerging role in combating antimicrobial resistance. Collectively, the reviewed literature underscores the therapeutic versatility of P. emblica and its strong potential as a natural candidate for the development of standardized herbal formulations, particularly in oral healthcare and periodontal disease management. Further clinical and mechanistic investigations are warranted to validate its efficacy and facilitate integration into modern pharmaceutical and dental applications.

INTRODUCTION

Phyllanthus emblica Linn. (syn. *Emblica officinalis* Gaertn.), commonly known as Amla or Indian gooseberry, is a prominent medicinal plant of the family Phyllanthaceae, widely distributed across tropical and subtropical regions and extensively utilized in Ayurveda, Unani, and Siddha systems of traditional medicine. Nearly all parts of the plant, including its fruits, leaves, seeds,

***Corresponding Author:** Dr. N. Astalakshmi
Address: *Senghundhar College of Pharmacy, Kumaramangalam, Tiruchengode, Tamil Nadu, India.*
Email : astalakshmisurendar@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

and bark, have been employed in traditional remedies, with the fruit regarded as its most therapeutically significant part owing to its exceptional richness in vitamin C, amino acids, and minerals [1]. Phytochemical investigations have revealed that *P. emblica* is a rich reservoir of bioactive secondary metabolites, including hydrolyzable tannins, phenolic acids, flavonoids, alkaloids, phytosterols, terpenoids, and organic acids, distributed across its fruit, leaves, bark, and roots [2]. These diverse phytoconstituents underlie the plant's extensive pharmacological profile, encompassing antioxidant, anti-inflammatory, antidiabetic, hepatoprotective, cardioprotective, immunomodulatory, and anticancer activities, reinforcing its considerable potential for the development of standardized herbal formulations and nutraceutical applications [1,2].

TAXONOMICAL CLASSIFICAION

Kingdom: Plantae

Division: Angiospermae

Class: Dicotyledonae

Order: Malpighiales

Family: Phyllanthaceae

Genus: *Phyllanthus*

Species: *Phyllanthus emblica* (L.)

A deciduous tree, 8-15 m tall, with alternate, subsessile leaves and greenish to creamy-yellow, unisexual, actinomorphic, trimerous flowers. Two varieties exist a wild type with smaller fruits and the cultivated "Banarasi" type with larger fruits [3].

REVIEW OF LITERATURE ON: *Phyllanthus emblica* Linn.

FRUIT:

❖ **Chavate et al., 2024** assessed the smear layer removal efficacy of 12.5% E. officinalis fruit extract activated by ultrasonic and XP-Endo Finisher systems, compared with 6% Morinda citrifolia and saline. The extract was prepared by cold maceration of dried fruit powder. Its major phytochemicals include gallic acid, emblicanin A and B, ellagic acid, and tannins, with an acidic pH contributing to calcium chelation. E. officinalis achieved satisfactory smear layer removal with both activation methods, although it was less effective than M. citrifolia activated with XP-Endo Finisher. The study supports its potential as an herbal endodontic irrigant [4].

❖ **Ambili et al., 2023** evaluated a novel herbal mouthwash (containing Emblica officinalis, Terminalia chebula, Terminalia bellerica, Glycyrrhiza glabra, and Azadirachta indica) for managing chronic periodontitis and radiation-induced mucositis through two randomized controlled trials. In Study 1, the herbal mouthwash produced reductions in plaque, gingival bleeding, and pocket depth comparable to 0.2% chlorhexidine, with fewer side effects such as staining and increased sensitivity. In Study 2, the herbal mouthwash significantly reduced the severity of radiation-induced mucositis and analgesic requirement compared to soda saline mouthwash in oral cancer patients undergoing radiotherapy [5].

❖ **Javed et al., 2023** conducted a systematic review and meta-analysis of 41 randomized clinical trials involving 2,806 participants to evaluate the effectiveness of Ayurvedic and herbal plaque control agents. Herbal interventions, including Triphala, Azadirachta indica, Aloe vera, green tea, and Curcuma longa, significantly reduced plaque index, gingival index, and bacterial

colony counts compared with baseline or placebo. Triphala demonstrated a near-significant reduction in plaque scores and showed efficacy comparable to chlorhexidine in several studies. The authors concluded that Ayurvedic and herbal oral care products are safe, effective adjuncts for plaque and gingivitis management and may be suitable alternatives in community dentistry [6].

❖ **Kripalani et al., 2023** valuated the antibacterial activity of E. officinalis extract against Streptococcus mutans in comparison with Vitis vinifera, Psidium guajava, and Acacia nilotica. The fruit extract, prepared by Soxhlet extraction, contained abundant alkaloids and flavonoids with moderate tannins and carbohydrates. E. officinalis completely inhibited S. mutans growth at all tested dilutions, demonstrating antibacterial efficacy comparable to V. vinifera and superior to the other extracts. The study concluded that E. officinalis is a promising natural anticaries agent [7].

❖ **Lakshmaiah et al., 2023** compared 6.25% Emblica officinalis, 12.5% Punica granatum, and 2.5% sodium hypochlorite as endodontic irrigants by evaluating dentin microhardness, smear layer removal, and dentinal tubule penetration. Both herbal extracts were prepared by cold maceration and demonstrated superior smear layer removal and deeper penetration into dentinal tubules than sodium hypochlorite. Punica granatum caused the least reduction in dentin microhardness, while E. officinalis also showed favorable biocompatibility and cleaning ability. The authors concluded that these herbal irrigants are promising alternatives to conventional irrigants, offering effective canal cleaning with reduced adverse effects on dentin [8].

❖ **Bane et al., 2022** evaluated the antibacterial efficacy of a sugar-free Emblica officinalis lollipop in reducing salivary Streptococcus mutans among visually impaired children. In this double-blind randomized study, children consumed the lollipop twice daily for seven days. The E. officinalis group showed a significant 30.65% reduction in S. mutans counts compared with the placebo group, along with a significant increase in salivary pH. The beneficial effects were attributed to the fruit's phenols, tannins, polyphenols, and flavonoids. The authors concluded that E. officinalis lollipops provide a safe, child-friendly approach for reducing cariogenic bacteria in special-needs children [9].

❖ **Chatzopoulos et al., 2022** systematically reviewed 22 clinical studies evaluating herbal oral care products as adjuncts to scaling and root planing or supragingival debridement in periodontitis patients. Herbal formulations, including Triphala, green tea, chamomile, Ocimum sanctum, lemongrass oil, and polyherbal products, were assessed for their effects on periodontal parameters such as probing pocket depth, clinical attachment loss, plaque, and gingival inflammation. Most studies reported superior outcomes compared with placebo, while several demonstrated results comparable or even superior to chlorhexidine. The review concluded that herbal oral care products are effective adjunctive therapies and offer a safer alternative with fewer adverse effects than chlorhexidine [10].

❖ **Khurana et al., 2019** reviewed the antimicrobial potential of Emblica officinalis (Amla), highlighting its broad-spectrum antibacterial, antifungal, and antiviral activities. The review reported that EO extracts were more effective against Gram-positive bacteria (e.g., S. aureus, B. subtilis) than Gram-negative bacteria, with antimicrobial activity attributed to tannins (emblicanin A and B), gallic acid, flavonoids (quercetin, kaempferol), and phenolic compounds. The review also discussed antiviral effects against

HSV, HIV, influenza A, and HPV, as well as emerging applications in green-synthesized silver, selenium, and zinc oxide nanoparticles for enhanced antimicrobial efficacy [11].

❖ **Mamgain et al., 2017** compared a Triphala-Elettaria cardamomum decoction containing E. officinalis, Terminalia chebula, and Terminalia bellirica with 0.2% chlorhexidine in patients with plaque-induced gingivitis. Prepared as an aqueous decoction from dried fruits, the formulation contains vitamin C, tannins, and other bioactive compounds that support gingival health. Significant reductions in plaque, gingival inflammation, and halitosis were observed, with no significant difference from chlorhexidine. The study concluded that the Triphala-Ela decoction is an effective and economical herbal alternative for oral hygiene [12].

❖ **Naiktari et al., 2014** evaluated the efficacy of Triphala mouthwash (containing equal parts of T. chebula, T. bellirica, and E. officinalis dry fruit powder) against 0.2% chlorhexidine in hospitalized periodontal disease patients. The plant part used was the dry fruit, prepared as an aqueous extract by dissolving 10 g of Triphala powder in 10 mL of boiling water. Major phytochemicals of E. officinalis noted include vitamin C, carotene, nicotinic acid, D-glucose, D-fructose, riboflavin, empicol, and mucic and phyllemblic acids. The mouthwash was used at 10 mL twice daily for two weeks, and Triphala showed antiplaque and antigingivitis efficacy comparable to 0.2% chlorhexidine with no reported side effects [13].

❖ **Velmurugan et al., 2013** compared the anticaries efficacy of 20% aqueous extracts of E. officinalis and T. chebula with 0.2% chlorhexidine in high caries risk patients. The plant part used was the leaf, ground into fine powder and extracted by cold maceration in sterile distilled water at 4°C for 72 hours, followed by filtration, evaporation at 40°C, and reconstitution in polyethylene glycol and distilled water to a 20% (w/v) concentration. Key phytochemicals include phenols, tannins, polyphenols, flavonoids, kaempferol, ellagic acid, and gallic acid. E. officinalis showed the highest percentage reduction of S. mutans (78.1%) and Lactobacillus (76.6%) among the three groups, outperforming both T. chebula and chlorhexidine in microbial reduction, though with shorter duration of action due to lower substantivity [14].

SEEDS:

❖ **Singh et al., 2022** investigated the antimicrobial, antioxidant, and anti-inflammatory activities of Emblica officinalis seed extracts, fractionated using hexane, chloroform, diethyl ether, and methanol. The methanolic extract showed the strongest phenolic/flavonoid content, DPPH radical scavenging activity, 15-lipoxygenase inhibition (IC50 58 µg), and antibacterial activity against E. coli and P. vulgaris. LC-MS identified gallocatechin and quercetin as key bioactive constituents, with quercetin showing the best docking affinity against 15-LOX [15].

❖ **Patel et al., 2020** evaluated the anti-infective potential of a hydroalcoholic extract of Phyllanthus emblica seeds (PESE) against Chromobacterium violaceum, Serratia marcescens, Pseudomonas aeruginosa, and Staphylococcus aureus. PESE exhibited quorum-modulatory activity at ≥50 µg/mL, reduced haemolysis, biofilm formation, and virulence in a C. elegans model, and enhanced antibiotic and serum susceptibility. Mass spectrometry revealed coumaric acid, gallic acid, catechin, and HHDP-hexosides as major constituents, supporting its traditional use against infections [16].

BARK:

❖ **AL-Gbouri & Hamzah, 2018** evaluated the antibacterial and antibiofilm activity of an ethanol:methanol (1:1) extract of Phyllanthus emblica against Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa using agar well diffusion, MIC, and MBC assays. The extract showed the strongest inhibition zones at 20 mg/mL (E. coli 27mm, S. aureus 25mm, P. aeruginosa 15mm), with MIC values ranging from 1.25-5 mg/mL and MBC from 2.5-10 mg/mL across the three organisms. The extract also inhibited P. aeruginosa biofilm formation on plastic surfaces in a dose-dependent manner (effective range 6.25-40 mg/mL), with cell adherence suppression exceeding 50% in most concentrations tested [17].

LEAVES:

❖ **Baburam et al., 2022** investigated the quorum sensing inhibitory potential of Phyllanthus emblica phytochemicals against Pseudomonas aeruginosa using molecular docking against LasR and CviR proteins. Compounds were retrieved from the Duke Ethnobotanical and PubChem databases and docked using FlexX. Cardamonin (CID_641785) showed the strongest binding affinity, exceeding natural AHL ligands, suggesting its potential as an effective anti-quorum sensing agent against P. aeruginosa [18].

❖ **Elangovan et al., 2015** evaluated the antibacterial and antifungal activity of petroleum ether leaf extract of Phyllanthus emblica obtained via Soxhlet extraction, using the disc diffusion method against five bacterial and three fungal strains. The extract showed strong activity against Staphylococcus aureus and E. coli (11 mm) and highest antifungal activity against Aspergillus niger (17 mm), with no effect on Enterococcus faecalis, indicating broad-spectrum antimicrobial potential [19].

WHOLE PLANT OR AERIAL PARTS:

❖ **Arzani et al., 2025** reviewed plant polyphenols, terpenes, and terpenoids relevant to oral health, listing Phyllanthus emblica (emblic) fruit among medicinal plants used for oral antimicrobial applications. The review noted a separate reference (Li et al.) characterizing P. emblica fruits as polyphenol-rich, with potential benefits for oral disease management, situating amla among numerous herbs (including clove, green tea, and miswak) who's phenolic and terpenoid constituents contribute to antimicrobial, antioxidant, and anti-inflammatory effects in dental applications [20].

❖ **Yang et al., 2024** reviewed strategies against Enterococcus faecalis biofilms in endodontic infections, referencing triphala (composed of Terminalia chebula, Terminalia bellerica, and Emblica officinalis, rich in tannins, polyphenols, and vitamin C) as a plant-derived endodontic irrigant. Triphala demonstrated significant antimicrobial efficacy against E. faecalis biofilms, though less effective than sodium hypochlorite, while offering advantages of lower toxicity, cost-effectiveness, and additional antioxidant and anti-inflammatory benefits compared to conventional irrigants [21].

❖ **Gul et al., 2022** reviewed the functional and nutraceutical significance of Phyllanthus emblica (amla) fruit, detailing its rich phytochemistry including polyphenols (gallic acid, ellagic acid, chebulinic acid, corilagin, emblicanin A and B, quercetin, kaempferol), ascorbic acid, and alkaloids (phyllantine, phyllantidine) distributed across fruits, leaves, and roots. The review compiled evidence from in vitro, animal, and

clinical studies demonstrating amla's antioxidant, anti-hyperlipidemic, antidiabetic, anticancer, anti-inflammatory, gastrointestinal-protective, and neuroprotective activities, primarily attributed to its polyphenol and vitamin C content [22].

❖ **Irfan et al., 2017** evaluated triphala mouthwash (containing Emblica officinalis, Terminalia belerica, and Terminalia chebula in equal parts, prepared by boiling 100g powder in 1000ml water) as a coadjuvant in chronic generalized periodontitis, comparing it to 0.2% chlorhexidine over 45 days in 50 patients. Triphala mouthwash showed significantly better reduction in gingival inflammation than chlorhexidine, with comparable plaque control and no adverse effects like the metallic taste reported with chlorhexidine. The efficacy was attributed to triphala's polyphenols, tannins, and ascorbic acid, including epigallocatechin gallate, which inhibit collagenase and bacterial growth [23].

REFERENCES

1. Alkefai, N. H., Altaf, A., Altaf, Z., Khanam, M., & Khan, A. (2023). Medicinal and Therapeutic Potential of Phyllanthus emblica (Amla-Indian Gooseberry): A Review. J Nutr Food Sci, 13, 021.
2. Prananda, A. T., Dalimunthe, A., Harahap, U., Simanjuntak, Y., Peronika, E., Karosekali, N. E., ... & Nurkolis, F. (2023). Phyllanthus emblica: a comprehensive review of its phytochemical composition and pharmacological properties. Frontiers in pharmacology, 14, 1288618.
3. Adyanthaya, S., Pai, V., & Jose, M. (2019). Evaluation of antimicrobial activity of Emblica officinalis against common oral pathogens. International Journal of Applied Dental Sciences, 5(4), 243–247.
4. Chavate, P. R., Ponnappa, K. C., & Nanjappa, A. S. (2024). Comparative evaluation of the effect of ultrasonic and rotary agitation of herbal irrigating solutions on smear layer: A SEM study. Journal of Conservative Dentistry and Endodontics, 27(2), 164-169.
5. Ambili, R., Ramadas, K., Nair, L. M., Raj, D., Nazeer, F., George, P. S., ... & Pillai, M. R. (2023). Efficacy of a herbal mouthwash for management of periodontitis and radiation-induced mucositis–A consolidated report of two randomized controlled clinical trials. Journal of Ayurveda and Integrative Medicine, 14(6), 100791.
6. Javed, D., Dixit, A. K., Anwar, S., Rai, A., & Krishan, K. (2023). Ayurvedic and herbal plaque control agents in gingivitis: A systematic review and meta-analysis of randomized controlled trials. Journal of Education and Health Promotion, 12(1), 378.
7. Kripalani, K. B., Thomas, N. A., Thimmaiah, C., Raj, K., Philip, L. M. N., Kajjari, S., & Oommen, V. M. (2023). Comparative evaluation of the phytochemical analysis and efficacy of four plant-derived extracts against Streptococcus mutans: An in vitro study. International Journal of Clinical Pediatric Dentistry, 16(Suppl 3), 258.
8. Lakshmaiah, D., Irudayaraj, N., Ambeth, N., Ramachandran, A., Sakthi, N., & Kumar, N. (2023). Comparative evaluation of microhardness, smear layer removal efficacy and depth of penetration using Punica granatum, Emblica officinalis and sodium hypochlorite as endodontic irrigants: an in vitro study. Cureus, 15(9).
9. Bane, S. P., Thosar, N. R., Rathi, N. V., Deshpande, M. A., & Deulkar, P. V. (2022). Comparative evaluation of antibacterial efficacy of emblica officinalis lollipop against Streptococcus mutans counts in institutionalized visually impaired children. Cureus, 14(8).
10. Chatzopoulos, G. S., Karakostas, P., Kavakloglou, S., Assimopoulou, A., Barmpalexis, P., & Tsalikis, L. (2022). Clinical effectiveness of herbal oral care products in periodontitis patients: a systematic review. International journal of environmental research and public health, 19(16), 10061.
11. Khurana, S. K., Tiwari, R., & Sharun, K. (2019). Mohd. iqbal yatoo, Mudasir bashir

gugjoo and Kuldeep dhama, Emblica officinalis (Amla) with a particular focus on its antimicrobial potentials: a review. J Pure Appl Microbiol, 13(4), 1995-2012.
12. Mamgain, P., Kandwal, A., & Mamgain, R. K. (2017). Comparative evaluation of triphala and ela decoction with 0.2% chlorhexidine as mouthwash in the treatment of plaque-induced gingivitis and halitosis: a randomized controlled clinical trial. Journal of Evidence-Based Complementary & Alternative Medicine, 22(3), 468-472.
13. Naiktari, R. S., Gaonkar, P., Gurav, A. N., & Khiste, S. V. (2014). A randomized clinical trial to evaluate and compare the efficacy of triphala mouthwash with 0.2% chlorhexidine in hospitalized patients with periodontal diseases. Journal of periodontal & implant science, 44(3), 134-140.
14. Velmurugan, A., Madhubala, M. M., Bhavani, S., Kumar, K. S. S., Sathyanarayana, S. S., & Gurucharan, N. (2013). An in-vivo comparative evaluation of two herbal extracts Emblica officinalis and Terminalia Chebula with chlorhexidine as an anticaries agent: A preliminary study. Journal of Conservative Dentistry and Endodontics, 16(6), 546-549.
15. Singh, P. G., Jain, A. S., Setty, P. B. S., Bv, S., Patil, S. S., Ts, G., ... & Basalingappa, K. M. (2022). Antimicrobial, antioxidant and anti-inflammatory activities of seeds from emblica officinalis (Gaertn.). Bioinformation, 18(8), 683.
16. Patel, P., Joshi, C., & Kothari, V. (2020). The anti-infective potential of hydroalcoholic extract of Phyllanthus emblica seeds against selected human-pathogenic bacteria. Infectious Disorders-Drug TargetsDisorders), 20(5), 672-692.
17. Al-Gbouri, N. M., & Hamzah, A. M. (2018). Evaluation of Phyllanthus emblica extract as antibacterial and antibiofilm against biofilm formation bacteria. Iraqi Journal of Agricultural Sciences, 49(1).
18. Baburam, S., Ramasamy, S., Shanmugam, G., & Mathanmohun, M. (2022). Quorum sensing inhibitory potential and molecular docking studies of Phyllanthus emblica phytochemicals against Pseudomonas aeruginosa. Applied biochemistry and biotechnology, 194(1), 434-444.
19. Elangovan, N. M., Dhanarajan, M. S., & Elangovan, I. (2015). Evaluation of antibacterial and antifungal activity of Phyllanthus emblica leaf extract. Int. Res. J. Pharm. Biosci, 2(2), 59-66.
20. Arzani, V., Soleimani, M., Fritsch, T., Jacob, U. M., Calabrese, V., & Arzani, A. (2025). Plant polyphenols, terpenes, and terpenoids in oral health. Open Medicine, 20(1), 20251183.
21. Yang, S., Meng, X., Zhen, Y., Baima, Q., Wang, Y., Jiang, X., & Xu, Z. (2024). Strategies and mechanisms targeting Enterococcus faecalis biofilms associated with endodontic infections: a comprehensive review. Frontiers in cellular and infection microbiology, 14, 1433313.
22. Gul, M., Liu, Z. W., Rabail, R., Faheem, F., Walayat, N., Nawaz, A., ... & Aadil, R. M. (2022). Functional and nutraceutical significance of Amla (Phyllanthus emblica L.): a review. Antioxidants, 11(5), 816.
23. Irfan, M., Kumar, S., Amin, V., & Cuevas-Suárez, C. E. (2017). Evaluation of the efficacy of triphala mouth rinse as coadjuvant in the treatment of chronic generalized periodontitis: A randomized clinical trial. Mouth Teeth, 1(1), 1-6.

HOW TO CITE: Dr. N. Astalakshmi, Deena Dhayalan K, Dhinagaran P, Muthumani V, Sugandhan G, Suguna V, Dr. M. Surendra Kumar, A Review on The Species: Phyllanthus emblica L., Int. J. of Pharm. Sci., 2026, Vol 4, Issue 8, 2297-2303. https://doi.org/10.5281/zenodo.21927094