A review on Terminalia arjuna a natural Anticoagulant for cardiovascular Health

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***Abstract*—*Terminalia arjuna* (Roxb.) Wight & Arn., commonly known as Arjuna, is a prominent medicinal plant widely used in traditional Indian medicine, particularly Ayurveda. Native to the Indian subcontinent, the bark of this large deciduous tree has been historically valued for its potent cardioprotective properties. The World Health Organization estimates that a significant portion of the global population relies on herbal medicines, underscoring the importance of plants like *T. arjuna* in primary healthcare.**

Phytochemical analyses reveal that *T. arjuna* is rich in bioactive compounds such as triterpenoids (arjunic acid, arjunolic acid), flavonoids, tannins, and glycosides, which contribute to its antioxidant, anti-inflammatory, and cardiotonic effects. Pharmacological studies support its efficacy in treating various cardiovascular conditions, including hypertension, congestive heart failure, angina, dyslipidemia, and ischemic mitral regurgitation. Additionally, the plant exhibits hepatoprotective, antidiabetic, and wound healing properties.

This review highlights the botanical profile, phytochemistry, ethnopharmacology, and therapeutic significance of *Terminalia arjuna*, emphasizing its role as a natural remedy for cardiovascular health and other systemic disorders.

I. INTRODUCTION

Medicinal plants have been used to cure human health disorders since ancient times. The World health organization (WHO) emphasized the importance of traditional medicines in poor nations to satisfy their healthcare needs. More than half of the global population uses herbal products on daily basis to treat diseases and improve their health (World Health Organization, 2002).

To compensate for their sedentary lifestyle, plants have acquired an extraordinary chemical repertoire .In addition, the chemical structures of natural plant compounds are often rather complex, with many chiral centers.

The world healthorganization has estimated that over 75% of the world's population still relies on plant derived medicines, usually obtained from traditional healers, for its basic health care needs1 . The arjuna, scientific name Terminalia arjuna, is a lofty evergreen tree that is indigenous to the Indian subcontinent. This tree often grows to a height of about 100 feet or 30 meters and bears yellow blooms and tapering leaves. The bark of the arjuna tree possesses therapeutic properties and has been used by people for centuries to treat different conditions. Arjuna is an exceptional herb that aids in facilitating a hale and hearty heart and diminishes the results of the anxiety and apprehension. In addition, using the bark of the tree endorses effectual functioning of the cardiac muscles.

The present attempt is to review and compile updated information on various aspects of Terminalia arjuna plant used all over the world.

Plant Profile

Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Myrtales
Family: Combretaceae
Genus: Terminalia
Species: T. arjuna
Zoological name: Terminalia arjuna

Fig: Bark of Terminalia Arjuna.

Plant Discription:

Arjuna is the large size deciduous tree. The height of the Arjuna tree reaches upto 100 feet. It is the evergreen tree with the yellow flowers and conical leaves. It has a smooth gray bark. Fruit is 2.5 -3.5 cm

long, fibrous woody, glabrous with 5 hard wings, striated with numerous curved veins.

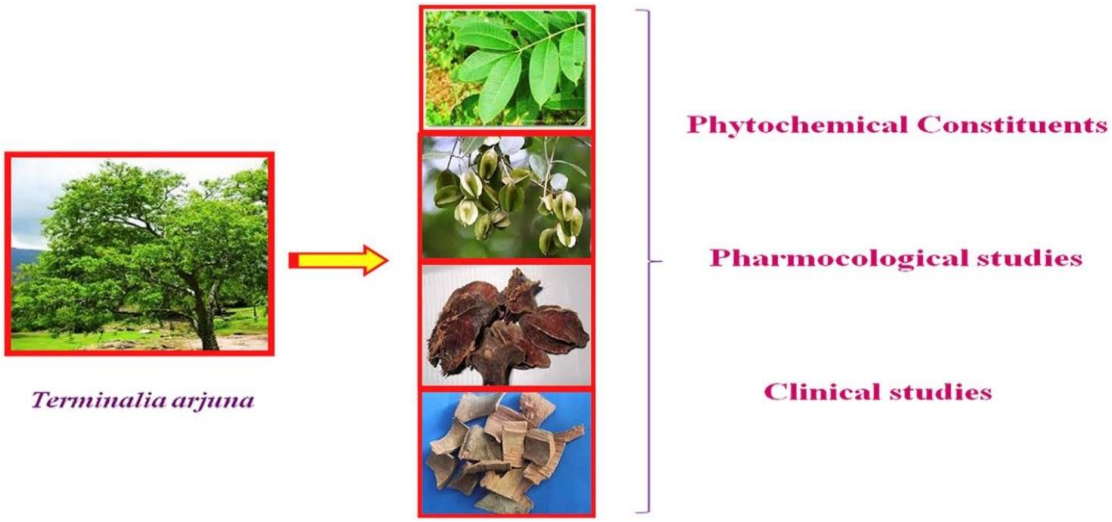
Habitate: Plant of Arjuna is found in every where in Indian planes such as from foot hills of Himalaya, Bihar, Bengal and Madhya Pradesh. Arjuna plant grows huge3,4 . Bark of Terminalia arjuna: It is simple, grey and smooth on external surface. The bark is thick, soft and of red color from inside.

The Leaves: Leaves are like that of Guava leaves - oblong, 4-6 inch long and 2-3 inch wide, subopposite, glabrous and often inequilateral. There are two glands near the base of the petiole. The margin is crenulate with apex at obtuse or subacute angle.

The base is rounded or cordate.

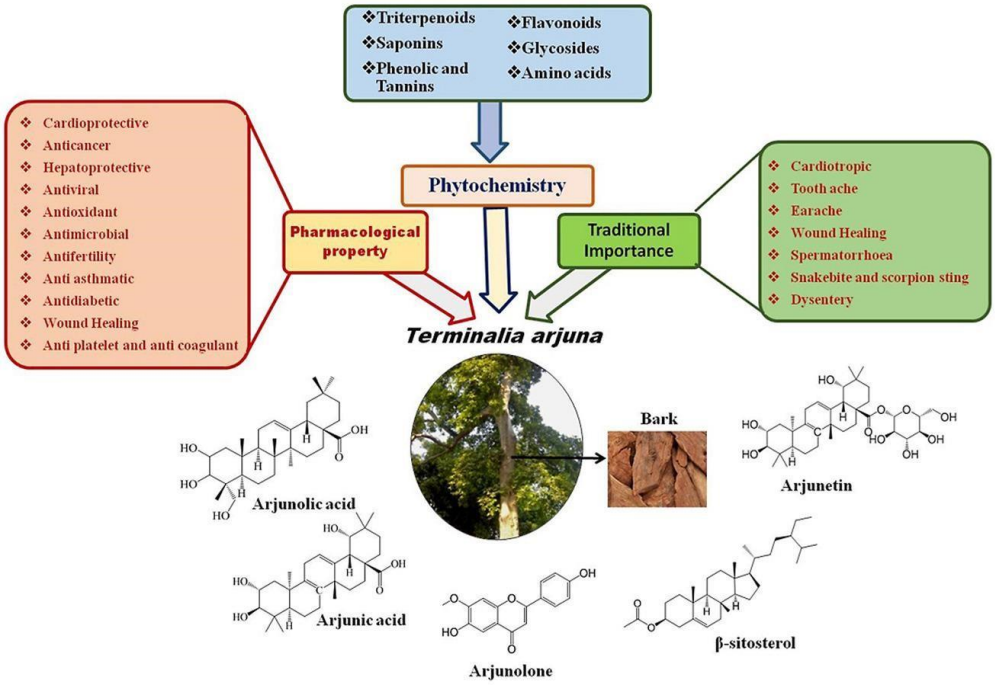
Flowers: White or yellowish flowers are found in groups. Flowering occurs in summer and fruits appear in winter

Fruits: The fruits are 1-1.5 inch in diameter and with 5-7 longitudinal lobes.These are glabrous with five to seven wings, woody and fibrous. Fruit is drupe and is often notched near the top, marked with oblique upward curving striations



Phytochemistry

The major constituents of *T. arjuna* in stem bark, root bark, fruits, leaves and seeds are well characterized (Table 1). The preliminary phytochemical analysis of existing compounds in *T. arjuna* was carried out according to various standard protocols as mentioned by Harbone[54] in Table 2. As bark was considered to be the most important constituent from the medicinal point of view, initially reported that the bark had 34% ash content consisting entirely of pure calcium carbonate.



Occurrences, botanical description and ethnopharmacology

T. arjuna is an ayurvedic plant with important medicinal value. It is commonly known as Arjuna, Indradru, Partha and Veeravriksha[20] which is belongs to Combretaceae family comprising of nearly 200 species distributed around the world. Nearly 24 species of *Terminalia* have been reported from various parts of India, some selected species are *T. arjuna*, *Terminalia bellirica*, *Terminalia bialata*, *Terminalia catappa*, *Terminalia elliptica*, *Terminalia porphyrocarpa*, *Terminalia mantaly etc*. In India, *T. arjuna* is about 60–80 feet in height, buttressed trunk and horizontally spreading crown and drooping branches distributed in India, Burma, Mauritius and Sri Lanka.19, 21, 22 *T. arjuna* is distributed throughout sub Indo-Himalayan tracts of Uttar Pradesh, Punjab, Deccan, South Bihar, Orissa, West Bengal and Madhya Pradesh mainly along riverside, rivulets and ponds. It is known by its various vernacular names, the most commonly used ones are Arjuna (Common Name), Arjun (Hindi), Marudhu (Tamil and Malayalam), Tella Maddi (Telugu), Arjhan (Bengali), Sadaru (Marathi), Sadado (Gujarati), Neer matti (Kannada) and some traditional formulations prescribe in the name of Arjunarishta and Arjunaghrita.

Leaves of *T. arjuna* are simple, often crenulations, borne sub-opposite, shortly acute or obtuse at the apex, coriaceous and oblong or elliptic. Their upper face is pale or dark green and the lower face is pale brown. The tree bears white sessile bisexual flowers in short auxiliary spikes or in a terminal panicle arrangement. Fruits of *T. arjuna* are drupe, ovoid, fibrous-woody and smooth-skinned with five hard wings or angles which are oblique and curved upwards. Stem bark is simple, smooth and pinkish-gray in color in external view. An internal view, the bark is soft and reddish in color.[23]

- Traditional Uses Following conditions in which Arjuna is extremely beneficial.
- Cardio modulator
- Blood pressure
- Hypo lipedimia
- Hyper lipidemia
- Hypercholesterolemia.
- Reduces stress
- Liver tonic

Urinary tract toner

Arjuna is very helpful in treating various health related problems. Below are actions of Arjuna as per the body's organ system

Pharmacological activity:
Cardiovascular effects: Terminalia arjuna offers a multitude of benefits for cardiac health through various mechanisms at the molecular level. The plant's oleanane triterpenoids, such as arjunic acid, arjunoglycosides, arjunone, and arjunolic acid, are primarily responsible for its cardioprotective effects. The bark stem of Arjuna contains diuretic, inotropic, and chronotropic effects. Its potent antioxidant activity helps reduce oxidative stress in cardiac cells, thereby preventing damage associated with heart diseases. The herb exhibits anti-apoptotic effects, reducing programmed cell death in cardiac cells during stress conditions like hypoxia, which is facilitated by the regulation of specific signaling pathways.

Therapeutic uses:
Terminalia arjuna, a well-regarded herb in traditional medicine, exhibits a broad spectrum of therapeutic applications, particularly in cardiovascular health and beyond.

[1] Cardiovascular Health: T.arjuna is predominantly recognized for its cardioprotective properties. Clinical studies demonstrate that its bark powder can effectively reduce the frequency of anginal attacks and improve overall cardiac function in patients with stable angina and coronary artery disease. Administration of 500 mg of the extract resulted in significant improvements in exercise tolerance as well as reductions in systolic blood pressure, plasma cortisol, and serum cholesterol levels. The extract of T. arjuna exhibits antithrombotic properties, contributing to reduced platelet aggregation in patients with coronary artery disease. This effect may play a crucial role in preventing thrombotic events

Cardio-protective activity: The Arjuna plant (lat. Terminalia arjuna) has traditionally been used to treat heart disease for centuries, that is why it got the nickname "Guardian of the heart". It was also known as hero of the famous epic "Mahabharata" because of its protective effects. Researchers studied the cardioprotective role of chronic oral administration of methanolic extract of T. arjuna bark in in vitro myocardial ischemic reperfusion injury and the induction of HSP72.

[2]Management of Congestive Heart Failure (CHF):
Research suggests that T.arjuna can improve the quality of life for CHF patients. In clinical trials, patients taking 4 g of bark powder daily reported improved functional status, increased diuresis, and reductions in both systolic and diastolic blood pressure.
Long-term follow-ups revealed sustained benefits in left ventricular function.
Rheumatic Heart Disease: T.arjuna has demonstrated efficacy in managing rheumatic heart disease. In doubleblind studies, T. arjuna causes significant improvements in left ventricular ejection fraction and functional capacity.

[4] Ischemic Mitral Regurgitation: In cases of ischemic mitral regurgitation postmyocardial infarction, T.arjuna has been shown to significantly decrease the severity of the condition and enhance diastolic function, leading to better overall cardiac performance [20].

[5] Cardiomyopathy:
The herb has also been studied for its role in treating cardiomyopathy. Observational studies suggest that when combined with standard therapies, T.arjuna leads to notable improvements in left ventricular ejection fraction and functional capacity [21].

[6] Oxidative Stress and Dyslipidemia:
Studies highlight the antioxidant properties of T.arjuna, showing its potential to improve lipid profiles significantly. It has been found to lower total cholesterol (TC), low-density lipoprotein (LDL), and triglyceride (TG) levels while raising highdensity lipoprotein (HDL) levels, thus mitigating cardiovascular risk factors. In a prospective cohort research, dyslipidemic patients were given T.arjuna powder (5 g, BD) for three weeks, followed by Arogyavardhini Vati (500 mg, BD) for four weeks. There was a significant reduction in TC, LDL, TG, serum C-reactive protein, blood glucose, and an increase in HDL levels, supporting the significance of T.arjuna in dyslipidemic patients [22].

[7] Endothelial Function:
Research involving smokers indicated that T.arjuna can positively affect endothelial health, leading to significant improvements in endothelial dysfunction.

[8] Other health benefits:
Terminalia arjuna is a versatile herb known for its numerous health benefits beyond cardiovascular applications. It has demonstrated significant wound healing properties due to its rich phytochemical composition, particularly tannins, which enhance collagen synthesis and improved tissue tensile strength. Additionally, T.arjuna shows promise in diabetes management by aiding glycemic control and improving insulin sensitivity.

II. CONCLUSION

Terminalia arjuna is a time-honored medicinal plant with deep roots in Ayurvedic medicine, recognized for its profound cardioprotective properties. Extensive phytochemical and pharmacological research supports the traditional claims, identifying key bioactive compounds such as arjunic acid, arjunolic acid, flavonoids, and tannins as responsible for its therapeutic potential. The plant exhibits a wide range of biological activities, including antioxidant, anti-inflammatory, antihypertensive, hypolipidemic, and anti-apoptotic effects, making it particularly valuable in the management of cardiovascular disorders such as angina, congestive heart failure, dyslipidemia, and ischemic heart disease.

Beyond its cardiovascular benefits, *T. arjuna* also contributes positively to wound healing, liver function, blood sugar regulation, and general health maintenance. Its safety profile and effectiveness, when used alone or as an adjunct to conventional therapies, further highlight its relevance in integrative and holistic healthcare systems. In light of its multifaceted pharmacological actions and the growing interest in plantbased medicines, *Terminalia arjuna* holds promise as a natural, accessible, and costeffective therapeutic agent. Continued scientific validation through clinical and pharmacological studies is essential to further explore its full potential and facilitate its integration into modern medical practice.

REFERENCES

[1] Vijayalakshmi Rajaram1,*, Ambalavanan Namasivayam1, Rajeshkumar Shanmugam2, Jaideep Mahendra1, Uma Sudhakar3, Tharani Munusamy4 & Uma Subbiah1, Terminalia arjuna: An overview of its magical properties
[2] Gaikwad, D., & Jadhav, N. (2018). A review on biogenic properties of stem bark of Terminalia arjuna: An update. *Asian J Pharm Clin Res*, *11*(8), 35-39.

[3] Soni, N., & Singh, V. K. (2019). Efficacy and advancement of Terminalia Arjuna in Indian herbal drug research: A review. *Trends in Applied Sciences Research*, *14*(4), 233-242.

[4] Dwivedi, S. (2007). Terminalia arjuna Wight & Arn.—a useful drug for cardiovascular disorders. *Journal of ethnopharmacology*, *114*(2), 114-129.

[5] Jain, S., Yadav, P. P., Gill, V., Vasudeva, N., & Singla, N. (2009). Terminalia arjuna a sacred medicinal plant: phytochemical and pharmacological profile. *Phytochemistry Reviews*, *8*, 491-502.

[6] Dwivedi S, Gupta D (2002) Modification of coronary risk factors by medicinal plants. J Med Aromat Plants 22:616–620

[7] Ayyanar M, Sankarasivaraman K, Ignacimuthu S. Traditional herbal medicines used for the treatment of diabetes among two major tribal groups in south Tamil Nadu, India. Ethnobot Leaf 2008;12:276-80.

[8] Dwivedi S, Udupa N. Terminaliaarjuna: Pharmacognosy, phytochemistry, pharmacology and clinical use a review. Fitoterapia 1989;60:413-20

[9] Kapoor D, Vijayvergiya R, Dhawan V. Terminalia arjuna in coronary artery disease: Ethnopharmacology, pre-clinical, clinical and safety evaluation. J Ethnopharmacol 2014;155:1029-45.

[10] Gupta LP, Sen SP, Udupa KN. Pharmacological studies on Terminalia arjuna. J Res Indian Med Yoga Homeopathy 1976;11:16-24.

[11] Paarakh, P.M., 2010. Terminalia arjuna (Roxb.) Wt. and Arn.: A review. Int. J. Pharmacol., 6: 515-534.

[12] Vijaya, T., V.A. Krishna and P. Sujathamma, 2015. Medicinal uses of Terminalia arjuna Roxb.: A review. HortFlora Res. Spectrum, 4: 176-178.

[13] Sivakumar, V. and S. Rajeshkumar, 2014. Screening of cardioprotective effect of Terminalia arjuna Linn. bark in isoproterenol-induced myocardial infarction in experimental animals. Int. J. Pharma Sci. Res., 5: 262-268.

[14] Parmar, H.S., S. Panda, R. Jatwa and A. Kar, 2006. Cardio-protective role of Terminalia arjuna bark extract is possibly mediated through alterations in thyroid hormones. Pharmazie, 61: 793-795.

[15] Parveen, A., R. Babbar, S. Agarwal, A. Kotwani and M. Fahim, 2011. Mechanistic clues in the cardioprotective effect of Terminalia arjuna bark extract in isoproterenol-induced chronic heart failure in rats. Cardiovasc. Toxicol., 11: 48-57.

[16] Khaliq, F. and M. Fahim, 2018. Role of Terminalia arjuna in improving cardiovascular functions: A review. Indian J. Physiol. Pharmacol., 62: 8-19.

[17] Kumar, V., Sharma, N., Saini, R., Mall, S., Zengin, G., Sourirajan, A., ... & El-Shazly, M. (2023). Therapeutic potential and industrial applications of Terminalia arjuna bark. *Journal of Ethnopharmacology*, *310*, 116352.

[18] Babasaheb, K. S., & Arif, P. T. (2018). Ayurvedic and modern aspects of arjuna (Terminalia arjuna roxb): An overview. *World J Pharm Res*, *7*, 1064-91.

[19] Gaikwad D, Jadhav N. A review on biogenic properties of stem bark of Terminalia arjuna: An update. Asian J Pharm Clin Res 2018

[20] Dwivedi S. Terminalia arjuna wight and amp; Arn. a useful drug for cardiovascular disorders. J Ethnopharmacol 2007

[21] Nema R, Jain P, Khare S, Pradhan A, Gupta A, Singh D. Preliminary phytochemical evaluation and flavanoids quantification of Terminalia arjuna leaves extract. Int J Pharm Phytopharmacol Res 2012; 1:283-6

[22] Maulik SK, Talwar KK. Therapeutic potential of Terminalia arjuna in cardiovascular disorders. Am J Cardiovasc Drugs 2012;1

[23] Mythili P, Parameswari CS, Dayana J. Phytochemical analysis of the bark extract of Terminalia arjuna and its cardioprotective effect. Indian J Innov Dev 2012;1:

[24] Rajaram, V., Namasivayam, A., Shanmugam, R., Mahendra, J., Sudhakar, U., Munusamy, T., & Subbiah, U. (2024). Terminalia arjuna: An overview of its magical properties. *Bioinformation*, *20*(12), 2080.

[25] Jain, S., Yadav, P. P., Gill, V., Vasudeva, N., & Singla, N. (2009). Terminalia arjuna a sacred medicinal plant: phytochemical and pharmacological profile. *Phytochemistry Reviews*, *8*, 491-502.

[26] Kumar, C., Kumar, R., & Nehar, S. (2013). Phytochemical properties, total antioxidant status of acetone and methanol extract of Terminalia arjuna Roxb. bark and its hypoglycemic effect on Type-II diabetic albino rats. *Journal of Pharmacognosy and Phytochemistry*, *2*(1).

[27] Amalraj, A., & Gopi, S. (2017). Medicinal properties of Terminalia arjuna (Roxb.) Wight & Arn.: a review. *Journal of traditional and complementary medicine*, *7*(1), 65-78.

[28] Paarakh, P. M. (2010). Terminalia arjuna (Roxb.) Wt. and Arn.: a review.

[29] Gupta, S., Bishnoi, J. P., Kumar, N., Kumar, H., & Nidheesh, T. (2018). Terminalia arjuna (Roxb.) Wight & Arn.: Competent source of bioactive components in functional food and drugs. *The Pharma Innovation Journal*, *7*(3), 223-31.

[30] Dwivedi S, Agarwal MP. Antianginal and cardioprotective effects of Terminalia arjuna, an indigenous drug in coronary artery disease. Journal of Association of Physicians of India. 1994; 42:287-289.