

Terminalia belerica .Roxb-A Phytopharmacological Review

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ABSTRACT

Terminalia belerica. Roxb (TB) is growing widely throughout the Indian subcontinent, Sri Lanka and SE Asia. In the Traditional system of medicine (TCM) like Ayurveda, Siddha and Unani, medicinal uses have been described as it works in disease of every system. Glucoside, Tannins, Galliacid, Ellagicacid, Ethylgallate, Gallylglucose, Chebulanic acid are mainly believed to be responsible for its wide therapeutic actions. It is used as antioxidant, antimicrobial, antidiarrheal, anticancer, antidiabetic, antihypertensive and hepatoprotective agent. The present article attempts to provide comprehensive information on phytopharmacological properties of *Terminalia belerica* for further research.

Key Words: Phytoconstituents, Phytopharmacology, *Terminalia belerica*, Traditional system of medicine.

INTRODUCTION

Plants produce wide array of bioactive principles and constitute a rich source of medicines¹. The herbal products can be isolated and identified as potential for medicines². Herbal medicines are prepared from a variety of plant materials as leaves, stems, roots, bark etc. They usually contain biologically active ingredients and are used primarily for treating mild or chronic ailments³. In India 45,000 plant species have been identified and out of which 15-20 thousand plants are of good medicinal value. According to World Health Organization (WHO) estimates, more than 80% of the people in developing countries depend on the traditional medicine for their primary health needs⁴. It is generally estimated that over 6000 traditional plants in India are in use folk and herbal medicine, representing about 75% of the medicinal needs of the Third World countries³. In view of this our attention has been focused particularly on *Terminalia belerica* belongs to family *Combretaceae*.

SYNONYMS

Assam - Bhomora, Bhomra, Bhaira;
 Eng - Beleric Myrobalan;
 Guj - Bahedam, Beheda;
 Hindi - Bahera;
 Kan - Shanti, Shantikayi, Tare, Tarekayi;
 Mal - Tanni, Tannikai;
 Mar - Beheda;
 Ori - Beheda, Bhara;
 Sansk - Vibhita, Aksa, Aksaka, Bibhitaki;
 Tam - Thanakkai, Tanri, tanrikkai, Tani;
 Tel - Tannikkaya, Vibhitakami, Tani;^[5,6]

PLANT DESCRIPTION

T. belerica also referred to as, **Beleric Myrobalan** in English, **Bibhitaki** in Sanskrit, Locally known as

Bahera in India, has been used for centuries in the Ayurveda, a holistic system of medicine originating from India. **The dried fruit used for medicinal purposes⁶**. It is found growing wild throughout the Indian subcontinent, srilanka, and SE Asia, upto 1200 meters in elevation, in a wide variety of ecologies. **It is a large deciduous tree with a buttressed trunk, a thick brownish gray bark with shallow longitudinal fissures, attaining a height of between 20and 30 meters. The leaves are crowded around the ends of the branches, alternately arranged, margins entire, elliptic to elliptic-ovate, rounded tip or sub acute, midrib prominent, pubescent when young and becoming glabrous with maturity. The flowers are pale greenish yellow with an offensive odor, borne in axillary spikes longer than the petioles but shorter than leaves. The fruits are ovoid grey drupes, obscurely 5- angled, narrowed into a very short stalk^{5,8}.**

Phytoconstituents

Glucoside (bellericanin)^{7,10}, Gallo-tannic acid, Coloring matter, resins and a greenish yellow oil⁸. Ellargic acid, gallic acid, lignans(terminalignan and thanni lignan), 7-hydroxy 3'4' (methylene dioxy) flavone and anolignan B¹⁰. Tannins, ellargic acid, ethyl gallate, galloyl glucose and chebulaginic acid, phenyllembin, β -sitosterol, mannitol, glucose, fructose and rhamnose^{6,5,10}.

Traditional uses

In Ayurveda the drug is classified as an expectorant. It is an integral part of Ayurvedic laxative formulation, Triphala used in treatment of common cold, pharyngitis and constipation^{5,10}. The bark is mildly diuretic and is useful in anaemia and leucoderma. The Fruits are Astringent, acid,

Digestive, Anthelmintic, Aperient, Expectorant, Sweet, Anodyne, Stypic, Narcotic, Ophthalmic, Antipyretic, Antiemetic and Rejuvenating. Unripe fruit is an mild laxative and ripe fruit is an astringent. Seeds are used as aphrodisiac. Oil extract from the seed pulp is used in leucoderma and alopecia. Modern investigations have proved the laxative activity of the oil^{5,9}.

PHARMACOLOGICAL ACTIVITIES

Acute and Sub acute Toxicities

Thanabhorn S. *et al.*, (2009) were conducted acute and sub acute toxicity studies as per the OECD guideline. Single oral administration of the ethanolic extract of *T. belerica* at a dose of 5,000 mg/kg did not produce any toxicity. In sub acute toxicity, repeated administration of 1,000 mg/kg of *T. belerica* over 14 days did not cause changes in terms of general behaviors, mortality, weight gain, hematological or clinical blood chemistry parameters. The results of histological examinations showed normal appearance of the internal organs when compared to those of the control group¹³.

Antioxidant, Antimicrobial and Toxicity Studies

Badrul Alam *et al.*, (2011) postulated that the crude methanolic extract of the fruits of *Terminalia belerica* Roxb along with its various organic fractions elicited both *in vitro* and *in vivo* antioxidant activity as well as antibacterial activity. Total antioxidant activity, scavenging free radical, authentic peroxynitrite and reducing power assessment were performed. Finally they concluded that the EtOAc fraction elicited strong activity in all the model systems with moderate toxicity¹.

Invitro glucoamylase activity

T. belerica fruit rind powder was assessed for its antimicrobial activity by using Chloroform-Ethyl Acetate fractions. Maximum zone of inhibition was observed in both fractions. The fractionized compound Epigallo catechin gallate showed significant antimicrobial activity against *E.coli*, *B. subtilis* and *S.Aureus* (Meshram Gangadar *et al.*, 2011)².

Anti diarrhoeal activity

The Anti diarrhoeal activity was performed using Castor oil induced diarrhoea, PGE2 induced entero pooling and gastrointestinal motility test (BimleshKumar *et al.*, 2010). Aqueous and ethanolic extract of fruit pulp of TB at the doses of 334 mg/kg, 200 mg/kg, 143 mg/kg were used. Comparison of percentage protection in these models revealed that the extracts have more prominent anti secretory effect than the reduction in gastrointestinal motility¹⁴.

Activities of Accessory reproductive ducts in male rats

Sharangouda *et al.*, (2010) was determined that Adult male rats were administered with 10mg and 25mg/100g body weight of benzene and ethanol extracts of *Terminalia bellirica* barks orally for 50 days. Epididymis, vas deferens was dissected out, weighed and processed for biochemical estimation. Repeated administration (10mg and 25mg/100g) of TB bark extract resulted in decreased weight of accessory reproductive ducts in male rats. The total cholesterol content was increased while protein content and epididymal sperm count were significantly decreased. These changes may be due to non-availability of androgens in *T. belerica* barks extracts treated rats¹⁵.

Streptozotocin induced Antidiabetic activity

Latha P.C.R *et al.*, (2010) investigated that Hexane, Ethylacetate and Methanolic extracts of TB fruit at the doses of 200, 300 and 400 mg/kg, p.o for 60 days to Streptozotocin induced diabetic rats significantly ($p < 0.05$) increased the plasma insulin, C-peptide and glucose tolerance levels, body weight, serum total protein. The effect was more pronounced in methanol extract treated rats. In addition the plant extracts significantly decreased the serum levels of total cholesterol, triglycerides, low density lipoprotein cholesterol, urea, uric acid and creatinine in diabetic rats¹⁶.

Analgesic activity

Arif Ullah Khan *et al.*, (2010) describes the antisecretory and analgesic activities of the crude extract of *Terminalia bellerica*. *T. bellerica* extract at the dose range of 300 - 1000 mg/kg inhibited the castor oil-induced intestinal fluid secretion in mice. The extract also dose-dependently (50 - 100 mg/kg) where it reduced the numbers of acetic acid-mediated in mice. These results indicate that TB exhibit antisecretory and anti-nociceptive effects, hence justifying its medicinal use in diarrhea and pain¹⁷.

Alloxan induced hyperglycemic and antioxidant activity

The continuous administration of TB fruits against alloxan induced hyperglycemia and antioxidant defense mechanism was studied in rats. Significant reduction of glucose level and Oxidative stress was observed. Increased levels of antioxidant enzymes such as Superoxide dismutase, glutathione reductase and catalase were observed in blood and liver (Sabu M C *et al.*, 2009)¹⁸.

Immune response Invitro

In vitro Phagocytic activity and lymphocyte proliferation assay were carried out in methanolic extract of on the mouse immune system (Aurasorn Saraphanchotiwitthaya *et al.*, 2008). In both assay,

stimulation of macrophage phagocytosis and maximal activation of phytohemagglutinin were observed. Finally, the authors concluded that the methanolic extract of *T. belerica* affected the mouse immune system, specifically both the cellular and humoral immune response *in vitro*¹⁹.

Antihypertensive Effect

Arif Ullah Khan *et al.* (2008) was screened the effect of TB in hypertension. After administration of TB, they observed that fall in the arterial BP of rats under anaesthesia. In isolated guinea-pig atria, inhibition of force and rate of atrial contractions noted. In rabbit thoracic aorta, relaxation was observed after the induction of contractions which was induced by phenylephrine²⁰.

Anti salmonella activity

Madani A *et al.* (2008) were studied the effect of *T. belerica* against *Salmonella typhi* and *Salmonella typhimarium*. *In vitro* cellular toxicity also performed by them. In this study, Petroleum ether, chloroform, acetone, alcohol and aqueous extract of TB fruit taken for screening. When compared with other extracts both alcoholic and aqueous extracts of TB showed significant anti salmonella activity. There was no cytotoxicity was observed in *in vitro* cellular toxicity study²¹.

Anti-Spasmotic and Bronchodialatory Properties

Anwarul Hassan Gilani *et al.* (2008) were postulated that the crude extract of TB fruits elicited relaxation of spontaneous contractions in both isolated rabbit jejunum and guinea-pig ileum. Protective effect of TB against castor oil-induced diarrhea and carbachol-mediated bronchoconstriction also observed in rodents. In guinea-pig trachea, TB relaxed the CCh-induced contractions²².

Hepatoprotective activity

Sangeetha Shukla *et al.* (2006) were evaluated the protective effect of TB fruit extract and its active principle, Gallic acid against CCl₄ intoxication. Treatment with extract (200, 400 and 800 mg/kg, p.o.) and gallic acid (50, 100 and 200 mg/kg, p.o.) showed dose-dependent recovery in biochemical parameters such as SGOT, SGPT and lipid peroxidase, glutathione but the effect was more pronounced with gallic acid.^[23]

Anti microbial activity

Elizabeth K M *et al.* (2005) were conducted the antimicrobial activity of TB against 9 human microbial pathogens. The Aqueous extract of dry fruit at 4 mg concentration showed highest zone of inhibition against *S. aureus*. These pathogens were highly sensitive to the methanol extract also except *E. coli* (enteropathogen) and *P. aeruginosa*. Finally they concluded that TB dry fruit possesses potential

broad spectrum antimicrobial activity²⁴.

CONCLUSION

The extensive survey of literature revealed that *Terminalia belerica*, is an important medicinal plant with diverse pharmacological spectrum. *Terminalia belerica* is widely used in Ayurveda, Siddha, Chinese medicine etc. The vast study done on the plant proved that the plant has many important phytoconstituents like Gallo-tannic acid, bellericanin, ellagic acid, gallic acid, termilignan, thanni lignan, flavone and anolignan B, Tannins, ellargic acid, ethyl gallate, galloyl glucose and chebulaginic acid, phenyllembin, β - sitosterol, mannitol, glucose, fructose and rhamnose. These compounds were found to be responsible for many of the pharmacological activities such as antimicrobial, antioxidant, antidiarrhoeal, antidiabetic, analgesic, immunomodulatory, antihypertensive, antisolmonella, hepatoprotective, antispasmodic and bronchodilatory activities. Further the plant is used in the treatment of gastric ulcer, constipation, general debility, piles. Hence, this plant provides a significant role in the prevention and treatment of a disease. Further evaluation needs to be carried out in order to explore the concealed areas and their practical clinical applications, which can be used for the welfare of the mankind.

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