Bangladesh Pharmaceutical Journal ***26****(2): 219-229, 2023 (July)* **- Review paper**

Review on *Bombax ceiba* Linn.: A Potential Remedy for Chronic Diseases

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(Received: January 4, 2023; Accepted: May 29, 2023; Published (web): July 25, 2023)

Abstract

Chronic diseases are serious health concern all over the world and these are adding immense sufferings to millions of people. These remain persistent in one's life and have long lasting effects on human life. Plant-based therapies can act as potential remedies to manage or cure these diseases with fewer, if not, no adverse effects and at a reasonable cost than the commercially available modern drugs. Furthermore, the constituents can be genetically modified to make them therapeutically effective against chronic diseases like diabetes, chronic inflammatory skin disease, chronic kidney disease, hypertension, cancer, ischemic heart disease and so on. *Bombax ceiba* Linn. is a tall, deciduous, multipurpose, miraculous tree that has numerous phytochemical constituents such as quercetin, carotenoids, β-sitosterol, α-tocopherol etc. along with shamimin, a novel compound that can help to treat chronic disorders. It has a long history for its medicinal uses. It is even highly regarded among aboriginal peoples for the remedy of various human and animal illnesses.

Key words: *Bombax ceiba* Linn, chronic disease, quercetin, carotenoids, shamimin, α-tocopherol, potential remedy.

Introduction

A chronic disease can be defined as a mental or physical health disorder that persists more than a year, creates functional limitations and that can only be controlled. Diabetes, hypertension, stroke, heart disease, respiratory disorders, cancer, arthritis are few of the numerous chronic diseases that have the ability to lead to hospitalization, persisting health impairment, lowered life quality and death. Chronic diseases affect the quality and wellbeing of life of thousands of people around the globe. Moreover, chronic diseases are established as a key source of healthcare expenses (Meetoo, 2022; Raghupathi and Raghupathi, 2018). These may be the result of a combination of physiological, genetic, behavioral and environmental factors. Multidimensional strategies are required to manage chronic diseases. In addition, nutritional and dietary planning, lifestyle changes and regular physical exercises are at the center of these strategies. The importance of nutrition to manage chronic disease is specifically very crucial as it can reduce risk factors for most of the chronic diseases that prevail both as single state and comorbid states. So, it is clear that nutrition is critical and significant for controlling chronic diseases (Ojo, 2019). Natural medicinal plants have long been employed in medicine (Greenwell, 2015). Medicinal plants are expected to have a bright future as a source of nutrition and drugs since there are so many plants on the planet and most of them have not yet been

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DOI: https://doi.org/10.3329/bpj.v26i2.67812

analyzed for their possible medicinal properties which could be extremely critical in the treatment of current or future disorders. Furthermore, some plants are regarded as vital sources of nutrition, therefore, some plants are suggested because of their possible medicinal properties (Hassan and Bassam, 2012). As a consequence, researchers have targeted the features and implications of plant extracts for the discovery of feasible nanomaterial-based medications to treat ailments (Greenwell and Rahman, 2015).

Bombax ceiba Linn. */Salmalia malabarica* Schott and Endl. is popularly known as the king of the forest. Shimul, Silk Cotton Tree and Shalmali are all popular names for *B. ceiba*. It can be found in subtropical and tropical countries of the continent of Asia, Australia, and Africa (Raut *et al.*, 2017). This tree belongs to Malvaceae family and can be particularly found in Indonesia, Malaysia, China, Hong Kong, and Taiwan. People call it "Salmari in Tibet", but in Europe and America, it is called the cotton tree. In some places of China, it is used to make tea (Alsayari *et al.*, 2018**).** The plant is useful for both economic and medical purposes. *B. ceiba* has widely been used as ayurvedic medicines in several countries for a long time (Raut *et al.*, 2017). Because of the existence of phenolic chemicals, sesquiterpenoids as well as naphtho-quinones, the root of the plant has a high antioxidant property. The antioxidant effect was experimented in humans and *in vitro* supports it for conventional medical applications (Jain *et al.*, 2011**).** It is a huge, long-lived tree that provides physical, mental and emotional power. *B. ceiba* has a huge history of medical usage in almost every single part of the tree, including the barks, roots, seeds and flowers (Verma *et al.*, 2011). *B. ceiba* has woody thorns on trunks and branches and large five-petaled crimson-red flowers that are pollinated by birds. Plants that are young (less than a year old) contain tuberous roots. These can be consumed raw or cooked. Flowers are meaty, luscious, non-odorous and delicious to the touch. Flowers are eaten uncooked or cooked with vegetables after the stamens are removed (Raut *et al.*, 2017; Anasane and Chaturvedi, 2017). Its leaves, rich in proteins, are one of the most popular food sources (Verma *et al.*, 2011). The primary nutrient profile results clearly suggest that *B. ceiba* flowers are a good nutritional supplement (Anasane and Chaturvedi, 2017).

B. ceiba is exceptionally noted for the stunning blood red blossoms that are utilized for creating nature and environmentally friendly colors during Holi, festival of colors of India. Poles of the plant are believed to be virtuous and they are planted about a month prior to the celebration. Because the blossoms are a primary attractant for various birds and insect feeders in the spring, the plant deserves to be considered as a keystone resource. It is a valuable multipurpose tree with numerous environmental advantages. This plant has shown to have modest SO_2 absorption effectiveness and so it can be suggested for roadside plantation in heavily polluted urban settings.

Materials and Methods

DESKTOP-EOLHRLH device was used to write this review based on the probable remedy of chronic diseases by using various parts of *B. ceiba* using Google Chrome, Mozilla Firefox,

Microsoft Edge search engines. More than 120 research articles were scrutinized that were found using preferred websites (International Journal of Advanced Research, Google Scholar, PubMed, ScienceDirect, Research Journal of Medicinal Plant) and they have been reviewed to find a possible connection between *B. ceiba* and chronic diseases. For this, some specific constituents have been given the priority in the review. Different tables of data obtained via research are assessed to firm the evidence scientifically. KingDraw Chemical Structure application has been used to draw the phytochemical constituents. Photo has been collected from Baghabo, Narshindi, Bangladesh using a phone camera (Figure 1).

Figure 1. *Bombax ceiba* with blossoms (May-June).

Results and Discussion

B. ceiba is a tall, deciduous tree with horizontally spreading branches and young stems coated in strong, stiff prickles that can grow up to 40 meters tall and up to 3 meters in radius and has a straight cylindrical stem with buttresses at the base (Chaudhary and Khadabadi, 2012; Sint, 2013). The bark color ranges from pale ash to silver gray. The flowers are quite gigantic in diameter, reddish-brown in hue and abundant in nectar (Chaudhary and Khadabadi, 2012). Pentamerous huge red blooms with thick and fleshy sepals bloom in the spring. The ovary of the flowers is well-protected, having a firm perianth with stiff filaments (Raut *et al.*, 2017). The fruits are like brown capsules that can be up to fifteen mm long and are stuffed with many black seeds that have irregular form. The pulp of the fruits is sweet. Leaves have a palmate look. It has a dignified, gigantic appearance. The plant has a common petiole. The leaf measures about fifteen-thirty cm in length. New leaves do not appear till the blossoming is finished. It may be found in India at altitudes of up to 1500 meters. In peninsular India, the tree can be found in both dry and damp deciduous forests, as well as along rivers. The

tree has a high light demand and grows quickly. Deep sandy loams or other well-drained soils are ideal for growing this plant, especially in valleys and areas receiving 50 to 460 cm of rain (Raut *et al.*, 2017; Chaudhary and Khadabadi, 2012).

Taxonomical classification (Chaudhary and Khadabadi, 2012)

Kingdom: Plantae Division: Magnioliophyta Class: Magniolipsida Order: Malvales Family: Malvaceae (Bombacaceae) Genus: *Bombax* Species: *B. ceiba; B. malabaricum; Salmalia malabarica* Schott & Endl.

Phytochemical constituents: A lot of compounds are available in different parts of *B. ceiba* as mentioned below.

Leaves: They contain sterol (β-sitosterol), alkane hydrocarbon (hentriacontane), alcohol (hentriacontanol), essential oil, tetrahydroxyflavone (kaempferol) flavonoid (quercetin, flavonol (shamimin), 4-C-β-D glucopyronosyl-1,3,6,8-tetrahydroxy-7-*O*-(4"-hydroxybenzoyl)-9H-xanthen-9-one, 2-C-β-D glucopyronosyl-1,6,7-trihydroxy-3-*O*-(4"-hydroxybenzoyl)-9H-xanthen-9-one, C-glycosyl [4-Cβ-D glucopyronosyl-1,6,8-trihydroxy-3,7-di-*O*-(4"-hydroxybenzoyl)-9H-xanthen-9-one] and mangiferin (Karole *et al.*, 2017).

Roots: They contain sesquiterpenoids (isohemigossylic acid, hemigossylic acid, bombamaloside, bombaxquinones, bombamalones), ether (lactone-2-methyl ether, lactone-7- methyl ether), flavonoid (3,4,5,7-tetrahydroxy-6-methoxy-flavan-3-ol-β-D glucopyranosyl-α-D-xylopyranoside), fatty alcohol (triacontanol), sterol (β-sitosterol), potassium nitrate, starch, alkaloid, terpenoid (Karole *et al.*, 2017; Chaudhary, 2018; Jain *et al.*, 2012).

Flowers: Flowers contain glycoside (quercetagetin, 4-*O*-β-glucoside), pigment (anthocyanin-A and B), fatty acid (palmitic acid, ethyl palmitate), sterol (β-sitosterol), amino acid (bombesin), flavonoid (vitexin, isovitexin), coumarin (esculetin, scopoletin, fraxetin and scopolin) (Chaudhary and Tawar, 2018; Joshi *et al.*, 2013).

Stem and bark: They contain lup-20(29)-en-3β-ol and 2-hexyl-7,8-dimethyl-1,4-naphthaquinone, named ceibanaphthaquinone trans-triacontyl-4-acetoxy-3-methoxy cinnamate (Chaudhary and Tawar, 2018).

Seeds: These contain primary fatty alcohol (N-hexacosanol), fatty acid (palmitic acid, stearic acid, oleic acid and linoleic acid, myristic, arachidic and behenic acid), vitamin E (α-tocopherol), carotenoids, amino acids (threonine, valine, methionine, isoleucine, leucine, phenylalanine, lysine, histidine, arginine and tryptophan), phytosterol, enzyme (lipase) and various sugars (Chaudhary and Khadabadi, 2012; Chaudhary and Tawar, 2018).

Gum: The gum contains sugars (2,3,4,6-tetra-2,6-di-, and 2,4-di-*O*-methyl-D-galactose and 2,3,5-tri and 2,5-di-*O*-methyl-L-arabinose 6-*O*-(β-D-galacto-pyranosyluronic acid)-D-galactose.

(Chaudhary and Khadabadi, 2012**;** Chaudhary and Tawar, 2018).

Heart wood: They contain 7-hydroxy-5-isoproyl-2-methoxy-3-methyl-1, 4-naphthaquinone (Chaudhary and Khadabadi, 2012).

Thorn: The hydroalcoholic extract of thorns of *B. ceiba* contains different types of compounds that were tested by different methods as presented in table 1.

Some of the important compounds obtained from *B. ceiba* have been described here with their chemical structures and presented in table 2.

Pharmacological activities: Different parts of *B. ceiba* show a variety of pharmacological activities which are briefly described in table 3.

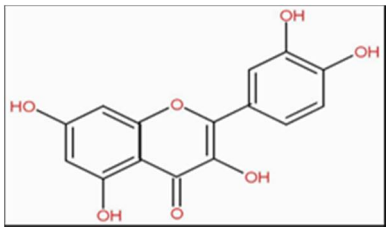
Activities of B. ceiba in different chronic diseases: B. ceiba shows excellent activities against a variety of chronic diseases such as diabetes, hypertension, kidney disease, inflammatory skin disease, cancer, ischemic heart disease, etc. A brief description of effectiveness of *B. ceiba* on each disease is given below -

(i) Diabetes: The tribals of toranmal prescribe and use the extract of *B. ceiba* in powder form to treat diabetes (Bhavsar and Talele, 2013). Clinical and experimental data indicate that oxidative stress has a role in type 1 and type 2 diabetes. Diabetes increases the risk of atherosclerosis which is elucidated in part by the increased oxidizability of low-density lipoprotein (LDL). This results in increased oxidative stress. Stress is related to reduction in antioxidant capability.

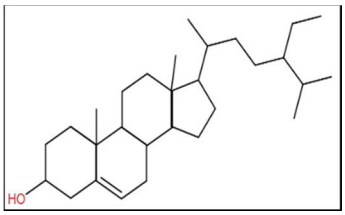
Table 1. Phytochemical profile of hydroalcoholic extracts of *B. ceiba* thorns (Kamble *et al.*, 2017).

Name of chemical constituents	Test conducted	Observations	Inference
Tannin	Gelatin test	Green color	Present
Saponin	Froth formation test	A small height froth formed for 5 mins	Absent
Phenol	$FeCl_3$ test	Bluish-black color	Present
Carbohydrate	Fehling's test	Red precipitate	Present
Sterol	Libermann-Burchard's test	Brown-ring formation	Present
Cardiac glycoside	Legal's test	No red color	Absent
Flavonoid	Shinoda's test	Pinkish-red color	Present
Diterpene	Copper acetate test	No emerald green color	Absent
Triterpene	Salkowski's test	No yellow color	Absent
Anthraquinone glycoside	Borntrager's test	Faint pink color	Present
Alkaloid	Hager's test	Yellow precipitate	Present

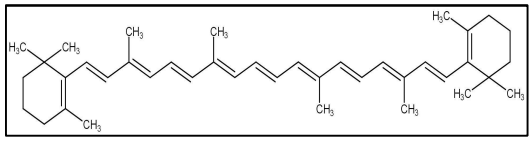
Table 2. Important phytochemical constituents of *B. ceiba.*



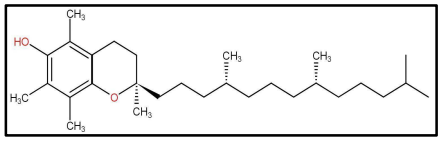
Quercetin



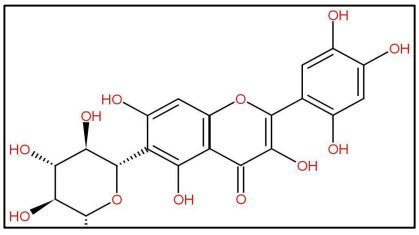
β-sitosterol



Carotenoids



α-tocopherol



Shamimin

Table 3. Pharmacological activities of *Bombax ceiba* (Chaudhary and Khadabadi, 2012; Kamble *et al.*, 2017; Akhtar and Siddiqui, 2019; Rameshwar *et al.*, 2014).

Constituent name	Activity	Research tool	Type of study	Effects
Active flavonoids and lupeol	Anti-obesity activity	Wistar rats	High fat diet induced experimental obesity	Modulation of fatty acid synthase and protein tyrosine phosphatase-1B signaling
Mangiferin, 2-β-D-glucopyranosyl-1,3,6,7-tetrahydroxy-9H-xanthen-9-one	Analgesic activity	Mice	Acetic acid induced writhing and hot plate test	-
Steroids, carbohydrate, tannins, triterpenoids, deoxy-sugars, flavonoids and coumarin glycosides	Antipyretic activity	Rats	Baker's yeast-induced pyrexia	
Triterpenoid compounds	Anti-diabetic activity	Rats	Streptozotocin induced diabetes	A dose of 600 mg/kg of *B. ceiba* extract significantly lowered total cholesterol and triglyceride levels
Unclear	Antimicrobial activity	-	Agar disc diffusion method	Effect against multidrug resistant *Salmonella typhi*
Shamimin, C-flavonol glucoside	Hypotensive and hypoglycemic activity	Sprague Dawley rats		A hypotensive agent at the doses of 15 mg/kg, 3 mg/kg, 1 mg/kg and significant hypoglycemic activity at 500 mg/kg
-	Hepato-protective activity	-	Against isoniazid and rifampicin	Significant decrease in alkaline phosphatase (ALP), alanine transaminases (ALT), aspartate transaminases (AST) and total bilirubin levels, but increase in the level of total protein in comparison to control
-	Aphrodisiac	Male mice	-	Significantly reduced mount latency (ML), intromission latency (IL), ejaculation latency (EL) and post-ejaculatory interval (PEI). Also significantly increased mounting frequency (MF), intromission frequency (IF) and ejaculation frequency (EF)
-	Anti-acne activity	Rats	-	Reduction in the number of blackheads and whiteheads, in number of inflamed pustules and overall inflammation.
-	Cytotoxic effect	-	Brine shrimp lethality test	An evaluation of medicinal plant bioactivity

In preclinical trial, blood glucose levels and glycated hemoglobin ($p < 0.001$) levels were significantly reduced by hydroalcoholic extract of *B. ceiba* at graded dosages (200 and 400 mg/kg of bw) and mangiferin (MF) in diabetic rats produced by streptozotocin (STZ). STZ does selective destruction of β-cell of pancreas through alkylation of DNA causing reduced synthesis and release of insulin (Bhargava and Shah, 2020).

In clinical trial, after pursuing a diet with low flavonol content for the previous 2 weeks, ten stable type II diabetes patients were subjected to a flavonol (quercetin) rich diet for 2 weeks in a dietary intervention trial. An oxidative stress test was

performed on lymphocytes. DNA damage was evaluated ex vivo. Following intake of the high flavanol diet, DNA damage was dramatically reduced (Willcox *et al.,* 2004). *B. ceiba* calyces are known to be good food for controlling diabetes as traditional vegetables. It showed that the aqueous methanol extract of the calyces decreased (12.4%) significantly ($p<0.05$) the progress of sucrose-induced postprandial hyperglycemic load in rats. It improved the glucose-stimulated insulin secretory process in MIN6 cells by lowering ADP/ATP ratio which was found through *in vitro* studies. Studies state that *B. ceiba* calyces possess phytochemical constituents containing antihyperglycemic, insulin secretory, insulin sensitization features. These provide an opportunity for exploring further possibilities of *B. ceiba* calyces to become included in the meals of people with diabetes (Komati *et al.*, 2022). Flavonoids and phenolics are abundant in *B. ceiba.* To quantify mangiferin in *B. ceiba* leaves, a validated RP-HPLC method was devised. It has anti-diabetic effects. Other linked degenerative diseases would be covered by the antioxidant potential (Willcox *et al*., 2004).

(ii) Hypertension: Hypertension, a disorder, if left without any treatment, can impair the major organs of the body. This is regarded as the silent killer because it can cause stroke, brain hemorrhage, heart problems, and renal failure without causing obvious symptoms. About 10%-15% people of the world have hypertension. Drugs used to cure it are extremely expensive and out of reach for the average person and have various side effects. Petroleum ether extract of *B. ceiba* stem bark generated 58% decrease in mean arterial blood pressure (MABP) of rats at 10 mg/kg dose. *B. ceiba* stem bark constituents lupeol and fraction of methanolic extract of *B. ceiba* have been identified as powerful hypotensive ingredients, while the novel dimeric glycoside shamimicin was shown to be inactive at a dose of 15 mg/kg (Saleem *et al.*, 2003).

(iii) Chronic kidney disease (CKD): Chronic kidney disease (CKD) is the 16th leading reason for the loss of lives worldwide. Chronic kidney disease can be defined as the existence of an abnormality in kidney structure/function persisting beyond 3 months (Chen *et al.,* 2019). The ethanol extract and aqueous extract prepared from young fruits of *B. ceiba* were administered following the method of Lipschitz *et al.* with few modifications to study the diuretic activity in male Wistar rats. Both the extracts of *B. ceiba* enhanced urination and defecation in rats when given orally at a dose of 2000 mg/kg. Though the diuretic impact of the extracts was moderate at first, it significantly extended the duration of action. As a result, it is likely to reduce the number of times a diuretic medicine is given (Jalalpure and Gadge, 2011). In elderly men, benign prostatic hyperplasia (BPH), or prostate gland enlargement, is prevalent. Urinating can be hampered by an enlarged prostate, which can increase the frequency and urgency of urination or cause issues emptying the bladder. BPH is treated with both surgery and medications otherwise it can lead to chronic kidney disease. Herbal treatments are increasingly being used to treat BPH symptoms. Well-known herbal remedies contain ∝-sitosterol, a constituent of *B. ceiba*, is the active component in the treatment of BPH. Treatments with β-sitosterol were well tolerated, according to the study. In individuals with mild to moderate BPH, improved urine symptoms and flow measurements were seen (Wilt *et al.*, 1999).

(iv) Chronic inflammatory skin diseases: α-tocopherol has been separated from *B. ceiba*. It has been associated with health of skin, from its potential uses in cosmetics to its incredible contribution in membrane integrity and also in the aging procedure. Future studies should explain the probable mechanism connected with preventative actions of vitamin E (Liu *et al.,* 2021).

(v) Cancer: Cancer is one of the major chronic diseases worldwide and is the second prime reason for the demise of millions of people (Siegel *et al.*, 2021). In developed countries, cancer is considered among main causes of death. The rise of drug-resistant cancers has necessitated the search for new and more effective treatments (Giordano and Tommonaro, 2019).

Anticancer efficacy of *B. ceiba* extract was tested *in vitro* utilizing the HL-60 cell line. The cell density was increased to 1.5106 cells/mL and the cells were treated with *B. ceiba* at concentrations of 1, 10, 25, 50, and 100 µg/ml for varying periods of time (Sharma *et al.*, 2020). Seeds of *B. ceiba* can exhibit anti-cancer activity (Donaldson, 2004). Twenty patients having advanced squamous cell carcinoma of the mouth were randomized to either a conventional diet with supplemental β-carotene or 60 Gy (Gray=100 Rads; Units of Irradiation) telecobalt therapy delivered in 30 daily fractions with synchronous chemotherapy consisting of vincristine, methotrexate and bleomycin. The findings imply that β-carotene has a protective effect on the mucosal barrier within the radiation beams tested (Nepomuceno, 2011). Methanolic extract of *B. ceiba* leaves (BCM) inhibited the viability of HL- 60 cells in a concentration-dependent manner at all concentrations. The decrease in cell viability in the groups with BCM at 1 µg /mL and 10 µg /mL ($P>0.05$) was not significant compared to the control group; But, BCM caused significant cell mortality at 25 µg /mL ($P<0.01$), 50 µg /mL ($P<0.001$), 100 µg /mL ($P<0.001$). BCM also increased the cell death by apoptosis (Sharma *et al.*, 2020). *B. ceiba* flower extract (BCFE) causes a rise in the early and late apoptosis which exhibits cancer cell destruction. Results of percentage of apoptosis and necrosis in MCF-7 cancer cells after treatment with two doses of *B. ceiba* flower extract is shown in table 4.

Table 4. Percentage of apoptosis and necrosis in MCF-7 cancer cells after treatment with two doses of *B. ceiba* flower extract.

BC extract	Apoptosis			Necrosis
	Total	Early	Late	
Control_MCF7	1.49	0.28	0.15	1.06
B. ceiba flower extract /mcf7_10 µg /ml	15.61	7.29	4.81	3.51
B. ceiba flower extract /mcf7_50 µg /ml	27.38	5.41	12.76	9.21

Treatment of Ehrlich ascites carcinoma in mice with BCFE showed a decent decrease in tumor cells and tumor size and increased the lifespans of tumor-bearing mice (Mahmoud *et al.*, 2020).

(vi) Ischemic heart disease (IHD): Cardiovascular disorders account for almost a third of all fatalities worldwide. Ischemic heart disease (IHD) is the most common type of cardiovascular disease (Khan *et al.*, 2020). *Bombax ceiba* root powder has been utilized by indigenous peoples for centuries to treat heart disease. Its possible role in heart disease has been discovered in recent scientific studies. *B. ceiba* root powder has been tested for its effect on various cardiovascular risk factors in people with ischemic heart disease, based on strong ethnomedicinal recommendations. In several scientific investigations, decreased fibrinolytic activity has been linked to IHD and it plays a key part in the catastrophic outcomes associated with these illnesses. Antioxidant supplementation, on the other hand, has been found to increase endothelial function. Total antioxidant status (TAS) increased by 107 percent after *B. ceiba* administration for twelve weeks, indicating that this key biological activity is beneficial to endothelial health in the coronary vascular system (Jain *et al.*, 2012).

Genome assembly of *B. ceiba:* The Plant Genomic DNA kit was used to extract genomic DNA from the leaves of a single tree (Tiangen, Beijing, China). With nineteen SMRT cells on a PacBio Sequel platform, single-molecule real-time sequencing of long reads was executed. The QIAGEN RNeasy Plant Mini Kit was used to extract total RNA from one individual root of *B. ceiba*, flower, bark, bud and fruit tissues (QIAGEN, Hilden, Germany). The genome size of the plant was calculated, utilizing sequencing data obtained from the Illumina DNA library, using K-mer approach. FALCON v0.3.0 was

used to assemble the genome using complete PacBio long reads (Yong *et al.*, 2018). Also in other research, utilizing sequences of transcriptomes generated by an Illumina paired-end sequencing approach, 33 polymorphic EST-SSR markers were created and distinguished for *B. ceiba*, among them 13 markers displayed polymorphisms among 24 individuals belonging from four different populations. Such novel SSR primers will aid in the progress of population and phylogeographic genetical studies, as well as investigation of the origins of *B. ceiba* populations belonging to China (Ju *et al.*, 2015).

Traditional uses: Ayurveda, the traditional Indian medicine, has mentioned its medicinal uses and formulations.

Charak Samhita: B. ceiba is described as one of the ten drugs used as tissue regenerator. Petioles or gum of *B. ceiba* is administered in dysentery and ulcerative colitis as enema.

Sushruta Samhita: The stem bark of *B. ceiba* is helpful for hemorrhagic diseases and reducing acne. It is also used topically to treat burns, wounds and stomatitis (Chaudhary and Tawar, 2018). There are some long-established uses of *B. ceiba* that are described in table 5.

Table 5. Long-established uses of *B. ceiba* (Depani *et al.*, 2019).

Beneficial parts	Uses	Preparation processes
Petal	Bright and soft skin	Fresh or dry petals collected from blossoms are blended with turmeric and water and the blend is applied on the skin.
Androecium	Food substance for summer	Dry androecium is cooked as food.
Thron	Alleviating pimples	Taking fresh thorn and crushing it with water, then it is applied directly on pimples.

Medicinal uses: Fine powder of *B. ceiba* can be used as a surgical dressing, after wounds have been cleaned. The gum (2 gm) is said to heal bleeding piles when blended with 30 mL milk of cow and 30 mL of water. It is mostly used by native women after delivery to stop menses during lactation. Petals that are soaked in cow's milk were employed to relieve conjunctivitis in newborns. In oral ulcers induced by mercury intake, mouthwash is used, which is the decoction of its gum (Akhtar and Siddiqui, 2019). Powdered root as well as milk and sugar candy were intaken to resist impotence. It was used to treat leprosy (Chaudhary and Khadabadi, 2012). Its tonic has been used to treat debility (Jain and Verma, 2014). If a phytochemical of interest is found, it can be isolated, purified, and characterized further. It can then be used to develop a new pharmaceutical product (Gopal, 2014).

Toxicity: Pollen allergies have been linked to the pollen of the plant in the Pondicherry area. *B. ceiba*'s pollen has been linked to recurring rhinitis and asthma. The heart, liver, and kidneys of mice were negatively affected by one of the most active hypotensive fractions of methanolic extract of defatted stem bark of *B. ceiba* at a daily dose of 1000 mg/kg (Akhtar and Siddiqui, 2019).

Future prospect of B. ceiba: Since the dawn of human civilization, plants have been one of the most important sources of medicines. Plant-based medications, health goods, pharmaceuticals, food supplements, cosmetics, and other products are in high demand (Chakraborty and Chakraborty, 2010). *B. ceiba* is a versatile tree that can be used for food, fiber, and fuel. As a result, it is ideally suited for social forestry projects and should be included among the medicinally and commercially significant plant species that should be farmed and protected (Vartika *et al.*, 2007). To confirm the plant's utility in medicinal aspects, more research on its biological and pharmacological activity in an animal model, as well as clinical trials are needed (Katisart and Kriintong, 2020).

Conclusion

B. ceiba has important pharmacological actions that can provide help to control chronic diseases and ease the pain of patients. It can be vastly used to generate efficient drugs and as a dietary source. Future research needs to be conducted to scientifically unveil its full medical potential. It can explore new opportunities in the arena of plant-derived medicines with less side effects. Preservation of *B. ceiba* should be enhanced for this purpose which will serve to maintain the ecological balance also. In the future, potential drug development can be possible and newly introduced drugs can increase the lifespans of people worldwide.

Author contributions: MSA has conceived the original idea; RSH, MRT and FA extensively reviewed the literature; JAC, AAC and SK critically reviewed the overall activities. All the authors read the article meticulously and agreed to submit the article.

Funding: This work has been a self-funded activity.

Acknowledgments

We express our gratitude to the authority of the Department of Pharmaceutical Chemistry for using the computers and other facilities of the Molecular Pharmacology and Herbal Drug Research Laboratory established under the HEQEP Project.

Conflicts of interest: The authors declare no conflict of interest.

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