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Research Article

Phytochemical analysis and antimicrobial activity screening of *Bombax ceiba* flowers

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Abstract

Traditional knowledge of medicinal plants is showing important and significant value to society. *Bombax ceiba* is an important medicinal plant of tropical and subtropical India. Its medicinal usage has been reported in the traditional systems of medicine such as Ayurveda, Sidha and Unani. The present study includes the detailed exploration of phytochemical properties, antimicrobial study and antioxidant activity of various extracts of *Bombax ceiba* in an attempt to provide a direction for further research. Freshly prepared extracts were exposed to standard phytochemical analysis for qualitative estimation of phytoconstituents. Phytochemical analysis revealed the presence of several phytochemicals viz., alkaloids, flavonoids, carbohydrate, steroids, phenol, tannins, saponins, protein, terpenoids and glycosides. Antibacterial activity of successive extracts (Petroleum Ether, Chloroform, Ethyl acetate, Ethanol, distilled water) of flower were carried out against Gram-negative bacteria *Escherichia coli*, and Gram-positive bacteria *Bacillus subtilis*. The testing was done by agar well diffusion method. Result revealed that *E.coli* was inhibited by Ethanol extracts at the concentration100 µg/ml, 150 µg/ml and the zone of inhibition was found to be 200 µg/ml 4.8 mm, 4.7 mm, 5.2 mm. For the same Ethanolic extract showed a good antibacterial activity against *Bacillus subtilis* with zone of inhibition of 4.3 mm, 4.8 mm against *Bacillus subtilis* at concentration of 150 µg/ml and 200 µg/ml. The antioxidant activity was evaluated using DPPH method. Present research suggests that the *Bombax ceiba* may serve as a good source of natural medicines in future. This might be used diseases.

Keywords: Phytochemical, *Bombex ceiba*, Antioxidant, Antibacterial.

INTRODUCTION

Since the ancient times, nature has been a huge source of medicinal plants. All over the world, plants have served as the richest source of raw materials for traditional as well as modern medicine (Parekh & Chanda, 2007; Yusuf et al., 2014). The medicinal value of plants is mainly due to the presence of some chemical substances known as phytochemicals. These are basically plant metabolites synthesized in all part of plant body by itself and have some definite physiological action on animals (Giri et al., 2014; Tasneef et al., 2013). Plants are major source of secondary metabolites which are formed as products of primary metabolism and produced for defense against predators (Unuofin et al., 2017). Phytochemicals have been associated with protection from and treatment of chronic diseases such as heart disease, cancer, hypertension, diabetes and other medical condition. Phytochemicals have been divided into six categories on the basis of their chemical structures and characteristics. These categories include lipids, phenolics, carbohydrate, terpenoid and alkaloids, and other nitrogen-containing compounds (Vega & Oomah, 2019). Each category, further division based on biosynthetic origin gives rise to further subcategories. Examples of such metabolites are tannins, alkaloids and flavonoids; they are known to be the brain behind the healing potentials of

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plants (Bhandary et al., 2012). *Bombax ceiba,* commonly known as the Silk cotton tree belongs to the genus Bombax and family Malvaceae which is an important medicinal plant of tropical and sub-tropical India (Vaidyaratnam, 1997; Rathore & Singh, 2019). This tree is also found widely in tropical Asia, Africa and Australia (Rani et al., 2016). The different parts of this plant have been used in the traditional system of medicines since ancient times (Jain et al., 2011). The tree is famous for its large, showy, six-inch flowers with thick, waxy, red petals that densely clothed leafless branch tips in late winter and early spring (Donald et al., 2012). Many parts of the plant (root, stem bark, gum, leaf, flower, fruit, seed and heartwood) are mainly used by various tribal communities and forest dwellers for the treatment of wide variety of ailments. Various activities have been reported in almost all parts of *Bombax ceiba*, some of these include hypertensive, antioxidant, hypoglycemic, antipyretic and hepatoprotective. It is used in tradition system of medicine and exhibits diuretic, dysenteric, emetic, diarrhoea, Wounds, Acne, skin blemish and pigmentation, cold and coughs (Verma et al., 2014).

Free radicals are highly unstable molecules due to unpaired electrons in their structure causing significant damage to the stable compounds by taking out electrons from these compounds to attain stability (Garg et al., 2012). Antioxidants can stabilize free radicals by donating hydrogen or electron to them thereby decreasing the risks of oxidative stress. Antiradicals are the compounds that can control the reactive species. It is proposed to employ more than one method for antioxidant activity to evaluate possible mechanisms of action of substances with antioxidant potential (Reihani & Azhar, 2012). Antioxidants are largely used to prevent oxidation of pharmaceuticals, cosmetics and food products. There is an increased interest to find new antioxidants from plants to replace the synthetic ones (Zhang et al., 2010).

Taxonomic position of *Bombex ceiba.*

Scientific classification:

Kingdom - Plantae

Subkingdom -Tracheobionta

Super division - Spermatophyta

Division - Magnoliophyta

Class - Magnoliopsida

Subclass - Dilleniidae

Order - Malvales

Family - Malvaceae

Genus - *Bombax*

Species - *ceiba* L

English name: Red silk cotton, kapok, silk cotton tree

Common Name: Hindi- semal

Anti-Acne effect

Bombax ceiba is used in many cosmetics and skin preparation. It helps in many simple skin problems like Pimples and skin infection. It has been shown to work alongside traditional acne medications. It is the main ingredient in the anti-acne (cream) formulation of “Himalayas’’ (Jain & Verma, 2014).

Pimples and skin disease

An Ethnomedicinal claim of some distinctive medicinal plants utilized by Pawara tribal in the Satpuda hills of Maharashtra showed that a decoction of the bark of this plant is used in skin disease. Bark powder of Bombax ceiba was boiled with water and given orally twice a day for 7 days to treat leucorrhoea (Kosalge & Fursule, 2009).

Cardioprotective effect

Root powder of this plant *Bombax ceiba* significantly modifies the coronary risk factors such as fibrinogen, atherogenic lipids, and oxidative stress in patients with ischemic heart disease. Moreover it has been reported with its antioxidant activity due to high amounts of phenolics and tannins (Tundis et al., 2014; Patel et al., 2011).

Muscular injury

An Ethnobotanical study on medicinal plants showed that its root and bark powder are used in muscular injury (Zheng & Xing, 2009).

Wounds

Ethnomedicinal uses of useful plants from Mysore and Coorg districts, Karnataka included bark powder of *B*ombax ceiba plant helps to heal wound of cattle (Kshirsagar & Singh, 2001).

Cold and cough

Mix *Bombax ceiba* root powder with black pepper and dry ginger powder. Take in small amount to cure cold and cough.

Anti-inflammatory activity

An Ethnobotanical study of traditional anti-inflammatory plants used by the Lohit community of Arunachal Pradesh showed that fresh paste prepared from the bark of *Bombax ceiba* mixed with cow dung and the prepared paste is applied on the back muscle of leg at night to treat inflammation (Nima et al., 2009). In an in-vitro study ethanol and aqueous extracts of bark of *Bombax ceiba* (1000 mcg/mL) demonstrates enough potential to stabilize Human Red Blood Corpuscles (HRBC) membrane and put forward its

anti-inflammatory activity (Anandarajagopal et al., 2013). Furthermore, the methanolic extract of flower shows anti-inflammatory activity against the acute paw edema induced by carrageenan (Said et al., 2011).

Antimicrobial and antibacterial activity

Plant extracts (acetone, methanol, and aqueous) activity observed against multidrug-resistant *Salmonella typhii* (Rani & Khullar, 2004). Methanolic and aqueous extract of stem-bark has also shown strong antibacterial activity against multidrug-resistant *Salmonella typhi* strains. Mangiferin isolated from ethanolic extract and it has antibacterial property and it inhibits the growth of *Candida albicans* (Vaghasiya & Chanda, 2009).

Hepatoprotective activity

According to a study, it was proved that the methanolic extract of flowers of *Bombax ceiba* causes signifcant decrease in alanine transaminases, alkaline phosphates, aspartate transaminases, and total bilirubin levels but increases in the level of total protein in comparison to control (Lin et al., 1992).

Cytotoxicity

Benzo[a]pyrene (BaP) in HT1080 cells in methanolic flower extract of *Bombax ceiba* has been shown to have defensive effects on the cytotoxicity including two ascorbic acid derivatives and four butyrol actone were isolated and the estimate active ingredients were analyzed. Mangiferin, 16 extract compounds. BaP- induced cytotoxicity was reduced by some isolated compounds such as Quercetin, kaempferol, butyrolactone derivative and (-) loliolide (Nakashima et al., 2018).

Antioxidant activity

The DPPH activity of ethanolic extract was found to have an IC50 value of 94.66 ± 0.049 (µg / ml). Whereas, the aqueous extract gave an IC50 value of 100.46 ± 0.36 against standard with an IC50 value of 91.53 ± 0.31. The methanolic extract of the root shows a high amount of tannins (15.45% w/w) and phenolics (30.95% w/w) and also it give DPPH radical scavenging activity according to the dosage (Jain et al., 2011).

Diuretic activity

The diuretic effect of aqueous and crude ethanol extracts of *Bombax ceiba* fruit (200 mg/kg and 400 mg/kg,) using acute model in rats, was significantly increased the urine output in higher doses.

Cancer cell growth inhibition

The flowers of *Bombax ceiba* were investigated for their chemical composition, antioxidant effects and anti proliferative activity against seven human cancer cell lines (Michigan Cancer Foundation-7 (MCF-7)), HeLa Henrietta Lacks), COR-L23, C32, A375, ACHN, and LNCaP cells (Jalalpure & Gadge, 2011).

Anti-diabetic activity

A dose of 600 mg/kg of *B*ombax *ceiba* extract is the most effective to cause significant ($p<0.001$) hypoglycemic and hypolipidemic effects on streptozotocin-induced diabetic rats. This dose also significantly ($p<0.001$) lowered the total cholesterol and triglyceride level in severely diabetic rats. Phytochemical and GC-MS study shows the triterpenoid compounds found in the extract, which may account for its significant hypoglycemic activity. The present study thus provides a scientific rationale that we can use this plant in diabetes (Bhavsar & Talele, 2013).

Angiogenesis activity

Isolate an active compound lupeol from the Methanolic extract of the stem bark demo that exhibits its action in antiangiogenic activity and significantly inhibited the tube like formation of human umbilical venous endothelial cells at 50 and 30 µg/mL. However the lupeol did not showed any effect on the growth of tumor cell in certain cell-lines study such as SK-MEL-2, A549 and B16-F10 melanoma (You et al., 2003).

Anti-Urolithiasis activity

Bombax ceiba fruit extract was reported to be effective against ethylene glycol induced calculi in rats. Pre-treatment with aqueous and ethanolic extract (400 mg/kg) significantly reduces renal excretion of calcium and phosphate in ethylene glycol challenged rats. The extract also significantly reduces the oxalate, calcium and phosphate excretion in urine. Crystal formation promotive constituents were also significantly lowered by both the extract. Along with this, this dug stop the stone forming substance like oxalate, calcium, and phosphate in the kidney (Gadge & Jalalpure, 2012).

MATERIALS AND METHODS

Sample collection and authentication

B. ceiba flowers were collected from campus of Sardar Bhagwan Singh University, Balawala, Dehradun in the month of November 2021 and authenticated from Botanical survey of India (BSI) Dehradun, (Accession No. 456) (Uttarakhand).

Preparation of plant extract

The plant material after collection was washed with distilled water to remove all fibrous and soil debris and then sun dried for 15 days. Dried sample was crushed into powder

by electric blender (electric grinder).The fine powder (200 gm sample extracted with 800 ml of each solvent) was than subjected to Soxhletion by using different solvents in increasing order of polarity (Petroleum ether, Ethyl acetate, Chloroform, Ethanol, Distilled water) (Shukla et al., 2020). The extract was then dried to remove almost all the moisture and solvents and thus the final products were kept in air tight containers and stored at 4°C in the refrigerator for further study.

Determination of extraction yield

The extraction yield (%) was calculated as follows:

Extraction yield (%) = weight of the extract after evaporating solvent and freeze drying/ dry weight of the sample ×100.

Qualitative phytochemical analysis

The extracts were tested for the presence of bioactive components by using following standard methods (Figure 1) (Sukumara-n et al., 2011; Harborne, 1973; Kokate, 1994; Sofowra, 1993).

Preliminary phytochemical investigation

All the extracts were subjected to preliminary phytochemical screening for the detection of various phytochemical such as alkaloid, flavonoids, carbohydrate, steroids, phenols, tannins, saponins, terpenoid, glycoside, protein and amino acid.

Detection of alkaloids:

Dissolve extracts in dilute HCL and then filter. The filtrate may be tested for following colour test, Mayer's reagent (cream ppt), Hager's reagent (yellow ppt) and Wager's reagent (reddish brown) to detect the presence of an alkaloid.

Mayer's reagent:

Test solution with Mayer's reagent (1.36 gm of mercuric chloride in 60 ml distilled water + 5.0 g of potassium iodide in 20 ml distilled water+ 20 ml of distilled water) gives cream ppt.

Hager's reagents:

Test solution with Hager's reagent (saturated aqueous solution of picric acid i.e. 1.0% w/w solution of picric acid in hot water) gives yellow ppt.

Wagner's reagent:

Test solution with Wagner's reagent (1.27 g of iodine and 2 g of potassium m iodide in 5ml of water and 100 ml distilled water) gives reddish brown ppt.

Detection of flavonoids

Alkaline reagent test:

Treat extracts with few drops of sodium hydroxide solution. Formation of intense yellow color, which becomes colourless on the addition of dilute acid indicates the presence of Flavonoids.

Test for carbohydrates

Molish's test:

Treat the filtrates with a drop of alcoholic naphthol solution in a test tube. After shaking, add conc. Sulfuric acid from the sides of test tube. Appearance of violet ring at the junction

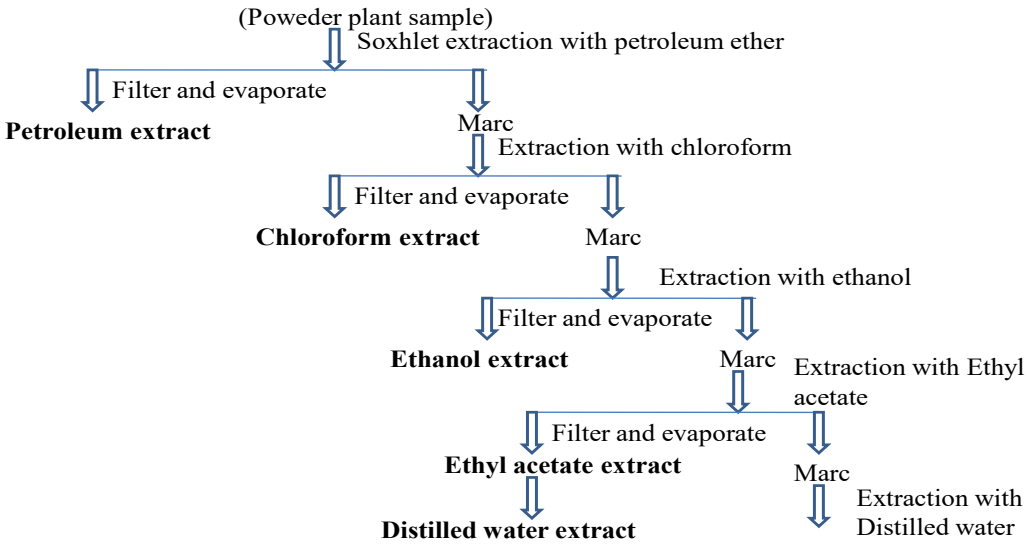


Figure 1: Showing the standard method follows.

of two layers indicates the positive test for reducing sugar.

Fehling's solution:

Mix Fehling's A and Fehling's B solutions and boiled for one to two minutes in a test tube. Equal volume of test solution was added to the mixture and heat on a water bath for 5-10 min. Appearance of yellow and then brick red precipitate indicates the presence of reducing sugars.

Benedict's solution test:

Mix equal volume of Benedict's reagent and plant extract was in test tube and heated in boiling water bath for 3-5min. Appearance of red colour solution indicates the positive test for reducing sugar.

Test for Steroids

Liebermann-burchard reaction:

Mix 2 ml of plant extract with chloroform and add 1-2 ml of acetic anhydride and 2 drops of conc. Sulphuric acid from the sides of test tube development of green colour reveals the positive test for steroid moiety.

Salkowiski reaction:

Add 2 ml of extract 2 ml chloroform and 2 ml conc. sulphuric acid. After shaking appearance of red colour in chloroform layer and greenish yellow fluorescence in acid layer reveals the positive test for steroids moiety.

Test for phenolic components and tannins

Small quality of test solution was dissolved in water and subjected for following test to detect the presence of phenolic compounds and tannins.

Dilute ferric solution:

Test solution with few drops of ferric chloride solution shows intense green colour.

Vanillin-HCL acid test solution:

Test solution with vanillin reagent (1 gm vanillin in 10 ml concentrated HCL) gives red colour which indicates the presence of phenolics.

Test for saponins

Add 1ml of the test solution dilute with distilled water to 20 ml and shake in a graduted cylinder for 15 minutes. A 1 cm layer of foam indicates the presence of saponins.

Test for terpenoids

Salkowski test:

Mix 5 ml of each extract with chloroform to this adds 3 ml of concentrated sulfuric acid. A reddish brown precipitate coloration at the interface indicates the presence of terpenoids.

Detection of glycosides

Hydrolyze Extracts with dilute HCl and then filter. The filtrate obtained is subjected to the following tests for glycosides.

Modified borntrager's test:

Treat extracts with 5% Ferric Chloride solution and immerse in boiling water for about 5 minutes. Cool the mixture and extract with equal amount of benzene. Separate the upper layer and treat with Ammonia solution. Formation of Rose Pink colour in the Ammonical layer indicates the presence of glycosides (anthranol, glycosides).

Legal test:

On treatment with sodium nitroprusside in Pyridine and NaOH. Formation of Pink to blood Red colour indicates the presence of glycosides (Cardiac glycosides).

Detection of protein test and amino acid test

Millon's test:

To 2 ml of 5 ml of extract, add few drops of Millon's reagent. A white precipitate shows the presence of protein.

Biuret test:

To 2 ml of extract add few drop of 2% copper sulphate solution. To this, 1 ml of ethanol (95%) is added followed by excess of KOH pellets. Pink colour in the ethanol layer indicat the presence of protein.

Ninhydrin test:

Add 2 drops of Ninhydrin solution (10 mg of ninhydrin 200 ml of acetone) to 2 ml of aqueous filtrate. A characteristic purple colour indicates the presence of amino acid.

Evaluation of antimicrobial activity

In vitro antimicrobial study was determined by agar well diffusion method (Pelczar et al., 1993). The bacterial strains used in the study were *Bacillus subtilis and Escherichia coli*, obtained from the Microbiology Department of Sardar Bhagwan Singh University, Balawala (Uttarakhand). The strains were identified by staining and morphological characteristics. The agar medium was prepared and then autoclave at 121^{o}C for 15 minutes and is poured into petri plates and allowed to solidity. The prepared culture plates were inoculated with a selected strain of bacteria under study using spread plate method. Four equidistant wells were made on the agar surface with sterile borer (6 mm), plant extract were dissolved in DMSO to make different

concentration i.e, 50 Mμg/ml,100 μg/ml,150 μg/ml and 200 μg/ml (dried). Plant extracts were then be poured into the well using micropipette. These plates were kept at 37°C for 24 hours. The diameter of zone of inhibition was measured in millimeters (mm). Any zone of inhibition around the well indicated the presence of antibacterial activity (Naz et al., 2015).

Antioxidant activity

DPPH radical scavenging activity:

15 mg of DPPH was dissolved in 10 ml of methanol. 75 µl of this solution was taken and the final volume was adjusted to 3 ml with methanol, absorbance was taken immediately at 517 nm for control reading. 75 µl of DPPH was added to a mixture of methanol and 50 µl of extract. The final volume was adjusted to 3 ml. Decrease in absorbance of the DPPH was measured 517 nm (Anandjiwala, 2007). DPPH radical scavenging assay was carried out and the result were expressed as a percentage inhibition of DPPH calculated from the following formula.

%radical inhibition = $([A_o\text{-}A1]/A_o) \times 100$

Whereas A_o= Absorbance of blank

A1= Absorbance of sample (Fernando & Soysa, 2015)

Thin layer chromatography

Preparation of TLC plate:

30gm of silica gel was weighed and made to a homogenous suspension with 60ml distilled water for two minutes. The suspension was distributed over the plate which was air dried until the transparency of the layer disappeared. The plates were dried in hot air oven at 110°C for 30 minutes and then stored in a dry atmosphere and used whenever required.

Application of the substance mixture for separation:

The solutions of the different samples were taken in capillary tubes and were spotted on a TLC (Thin Layer Chromatography) plate 2cm above its bottom.

Development of the chromatogram:

After the application of the sample on the adsorbent the TLC plate was kept in the solvent in TLC glass chamber and allowed the mobile phase to move through adsorbent phase upto 3/4th of the plate. The separation took place and the colored spots were obtained.

Rf = Distance traveled by solute/ Distance traveled by solvent (Hajnos et al., 2008; Harbone, 1973).

RESULTS AND DISCUSSION

(**Table 1**) Phytochemical analysis revealed the presence of several phytochemicals viz., alkaloids, flavonoids, steroids, phenol, tannins, terpenoid and glycosides. The test for alkaloid has given positive result whereas saponin and protein test showed negative result for all four extracts taken under study. Glycosides were present only in Ethanol and Ethyl acetate extract. Similarly phenolic compounds and tannins were to be presence in all the extracts except Petroleum ether extract (**Table 2**).

All the extract (Petroleum ether, chloroform, Ethanol, Ethyl acetate, Distilled water) of the plant at different concentration (50 µg/ml,100 µg/ml,150 µg/ml,200 µg/ml) exhibited antibacterial activity against the *E. coli* and *Bacillus subtilis*. Plant extract showed significant activity against both Gram positive *(Bacillus subtilis)* and Gram negative *(E. coli)* bacteria in dose dependent manner. Against the bacteria *E.coli* Ethanolic extract showed the maximum antimicrobial activity with the zone of inhibition of 5.2 mm at the cons of 200 µg/ml. while the maximum antimicrobial activity was shown by Distilled water extract with the zone of inhibition of 3.9 mm at the conc. of 200 µg/ml. Similarly the bacteria *Bacillus subtilis* Ethanolic extract showed the maximum antimicrobial activity with the zone of inhibition of 4.8 mm at the concentration of 200µg/ml. while the minimum antimicrobial activity was shown by Petroleum ether extract with the zone of inhibition of 3.6 mm at the concentration of 200 µg/ml (**Figure 2 and Figure 3**).

Table 3, shows the antioxidant activity of different extracts of *Bombex ceiba* flower. Extract of *Bombax ceiba* flower were analyzed against DPPH synthetic radical. Ascorbic acid was used as a standard reference for anti- oxidant activity. The inhibition activity of the plant extract was comparatively lower than the ascorbic acid. Petroleum ether extract showed the lowest antiradical activity while Ethyl acetate showed moderate activity and distilled water showed the highest antiradical activity is comparison to Petroleum ether and Ethyl acetate. Thus the result shows that the Ethyl acetate and Distilled water were most efficient antioxidant than Petroleum ether (**Figure 4**).

Thin layer chromatography

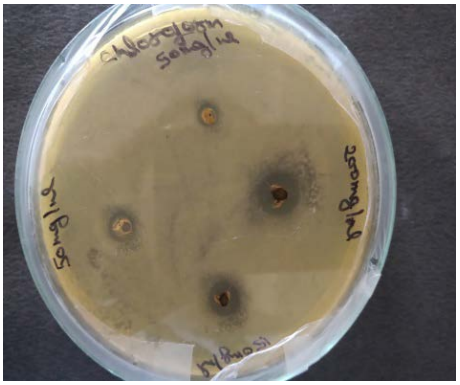
Table 4 shows the Rf value of Flower Extract of *Bombex ceiba*, (**Table 4, Figure 5**) Thin layer chromatography of the Petroleum ether, Chloroform and Distilled water extract were carried out separately using Hexane: Ethyl acetate (90:10) as mobile phase for petroleum ether, Hexane: Ethyl acetate (5:2) as mobile phase for chloroform extract and n-butanol: Acetic acid: Water (6:1:2) for aqueous extract as solvent system respectively and the R_f values were recorded as 0.9, 0.9, 0.8, 0.4 for Petroleum ether, Chloroform, Distilled

Table 1. Qualitative phytochemical analysis of extracts of *Bombax Ceiba* flower (-ve A sign indicates absence of constituent in the respective screening test; +ve sign indicates the presence of a constituent in the respective screening test).

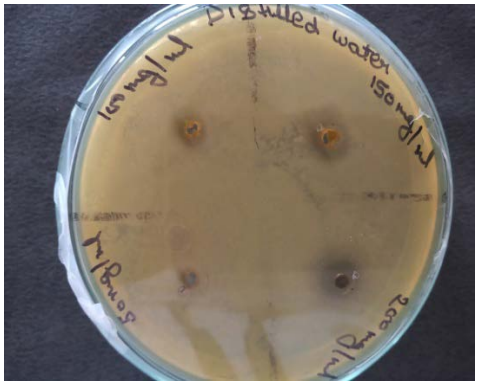
Phytochemicals	Test performed	Petroleum Ether extracts	Chloroform extracts	Ethanol extracts	Ethyl acetate extracts	Distilled Water extracts
Alkaloids	Mayer's test	+	+	-	+	-
	Hager's test	-	+	+	-	-
	Wagner's test	+	+	-	-	+
Flavonoids	Alkaline Reagent test	+	+	-	+	-
Test for Carbohydrate	Fehling's solution test	+	-	-	+	+
	Benidict solution test	-	+	-	+	+
Test for Steroid	Salkowski reaction	+	+	+	-	-
Test for phenolics components and tannins	Dilute ferric chloride solution test	-	+	+	+	+
	Vanillin HCL acid test solution	-	+	+	+	+
Test for Saponins	Foam test	-	+	-	-	+
Test for terpenoids	Salkowski test	+	+	+	-	-
Detection of protein	Biuret test	-	-	-	-	-
	Ninhydrin	-	-	-	-	-
Glycoside test	Keller-Killiani test	-	-	+	+	-

Table 2. Antimicrobial activity shows of different extract *Bombax ceiba* flowers.

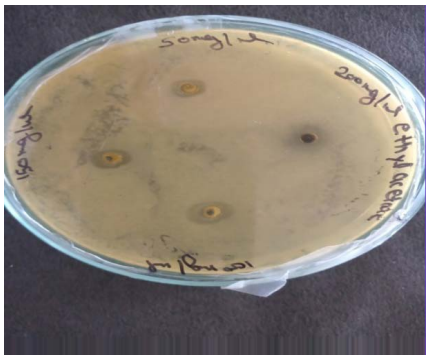
Micro-Organism used	Zone of Inhibition (in mm)																			
	Petroleum ether Extract				Chloroform Extract				Ethanol Extract				Ethyl acetate Extract				Distilled water Extract			
Concentration(µg/m)	50	100	150	200	50	100	150	200	50	100	150	200	50	100	150	200	50	100	150	200
E. coli	3.2	3.6	4.2	4.3	3.2	3.6	3.8	4.2	4.2	4.8	4.7	5.2	3.6	3.8	4.2	4.8	3.4	3.6	3.7	3.9
Bacillus subtilis	2.8	2.9	3.2	3.6	3.3	3.5	3.7	4	2.6	3.8	4.3	4.8	3.2	3.6	3.9	4.2	3.2	3.5	3.6	3.8



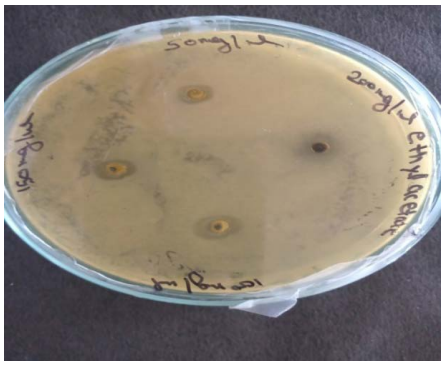
***Escherichia coli* (Chloroform)**



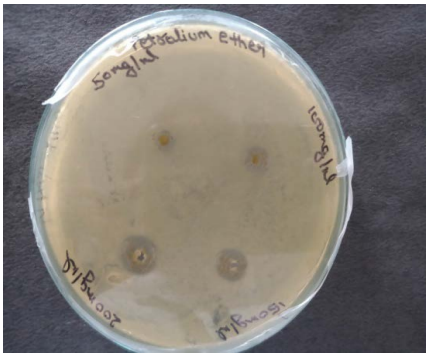
***Escherichia coli* (distilled water)**



***Escherichia coli* (ethanol extract)**



***Escherichia coli* (ethyl acetate)**



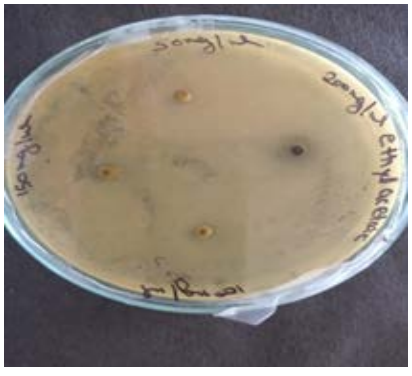
***Escherichia coli* (Petroleum ether)**

Figure 2: Effect of flower extract of *Bombax ceiba* on E. coli.

***Bacillus subtilis* (chloroform)**

***Bacillus subtilis* (Distilled water)**

***Bacillus subtilis* (Ethanol)**



***Bacillus subtilis* (Ethyl acetate)**

Figure 3: Effect of flower extract of *Bombax ceiba* on *Bacillus subtilis*.

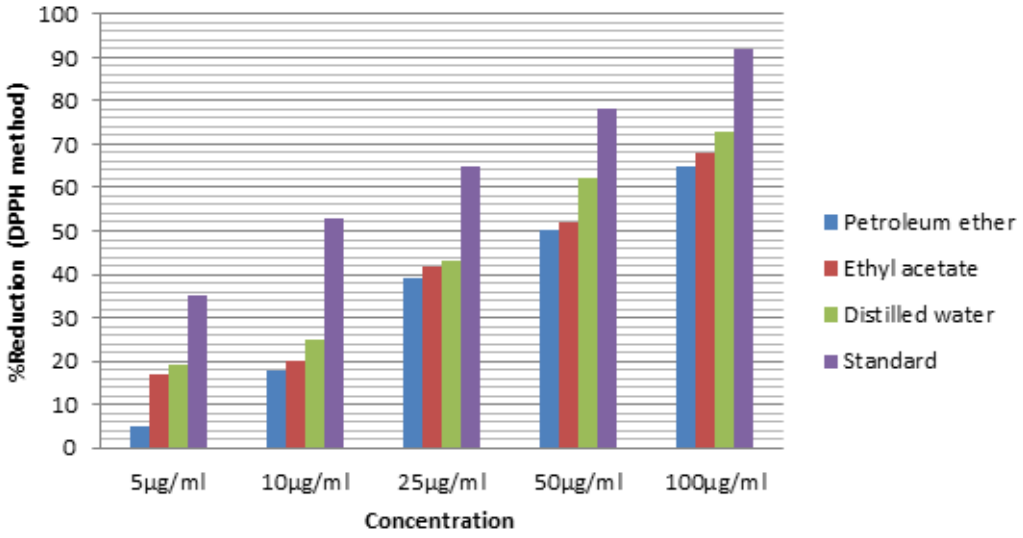


Figure 4. Graphical Representation of *Bombax ceiba* extracts DPPH scavenging activity.

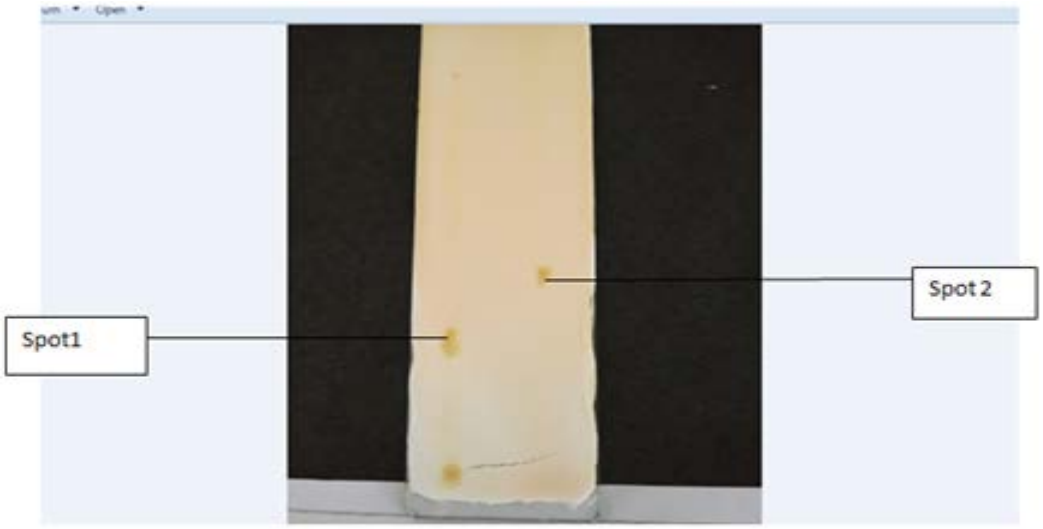


Figure 5. Showing Thin Layer Chromatography in Chloroform extract.

Table 3. Antioxidant activity of different extract of the *Bombex ceiba* flower.

Concentration (mg/ml)	Petroleum ether (%)	Ethyl acetate (%)	Distilled water (%)	Standard (%)
5 µg	13	17	19	35
10 µg	18	20	25	53
25 µg	39	42	43	65
50 µg	50	52	62	78
100 µg	65	68	73	92

Table 4. R_f value of different extract of *Bombax ceiba* flower extract.

S.No	Extracts	Solvent System	number of spot	R_f value	Visualizing agent
1	Petroleum ether extract	Hexane:Ethyl acetate (90:10)	1	0.9	Iodine chamber
2	Chloroform extract	Hexane:Ethyl acetate(5:2)	2	0.9, 0.82	Iodine chamber
3	Distilled water extract	n-butanol :Acetic acid: water(6:1:2)	1	0.4	Iodine chamber

water extracts respectivly. The visualizing reagent employed was exposer to iodine vapours to effect visualization of the resolved spots.

CONCLUSION

In the present work phytochemical, antimicrobial and antioxidant activity of *Bombax ceiba* was performed. Successive solvent extraction was done using soxhlet. Preliminary phytochemical screening of *Bombax ceiba* gave valuable information about the different phytoconstituents present in the plant.

It showed the presence of various phytochemicals like alkaloids, carbohydrate, flavonoids, phenols, tannins and amino acid. It is potential source of antibacterial and antioxidant.

Free radical scavenging activity was determined according to DPPH method. Distilled water extract of *B. ceiba* showed maximum antiradical activity compare to Ethyl acetate and Petroleum ether. The present study support that medicinal plant has antimicrobial activity can be used for medicinal purpose. The ethanolic extract of *Bombax ceiba* shows best MIC (maximum inhibitory concentration) against *E. coli*. Ethyl acetate extract shows best MIC against *Bacillus subtilis*. Therefore, extracts from these plants can be used as a good source for useful drugs and their quantified values can be used as a major tool for obtaining a quality control profile for drug.

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