Antibacterial and antioxidant properties of *Crateva magna* bark crude extract

By

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A thesis submitted to the Department of Mathematics and Natural Sciences in partial fulfillment of the requirements for the degree of
Bachelors

Mathematics and Natural Sciences
Brac University
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Declaration

It is hereby declared that

1. The thesis submitted is my original work while completing my degree at Brac University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material that has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I have acknowledged all main sources of help.

Student's Full Name & Signature:

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Approval

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of Spring, 2019 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Bachelor of Science in Microbiology in Summer, 2023.

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Abstract

Chemical compounds derived from plants have been used to treat several diseases all over the world since the dawn of human civilization. Many of the drugs that are currently on the market have either been directly or indirectly produced from plants, which have historically been an excellent source of pharmaceuticals. Bangladesh is home to a significant medicinal plant: *Crateva magna*. The plant *Crateva magna* is locally known as "Borun". The anti-inflammatory capabilities of this plant are well known. Numerous pharmacological properties have been reported for *C.magna* as well as several traditional uses that need to be thoroughly scientifically examined. The work in this thesis project details the antioxidant and antibacterial activity of one species of *Crateva.* Not enough work had been reported previously on this species and this species is grown in Bangladesh and has not been studied extensively so far. The bark of *Crateva magna* was extracted with dichloromethane and methanol, then subjected to partition, followed by thin-layer chromatography. In addition, an antioxidant test and antibacterial test were performed. Chloroform and ethyl acetate partition extract showed mild antibacterial activity. However, chloroform, ethyl acetate, methanol, and hexane partition extract showed up to 70.96%, 74.75%, 56.16%, and 33% of free radical inhibition activities respectively. Visualizing the TLC plate exhibits that several compounds are present in the chloroform, ethyl acetate, and hexane part. Hence, the findings of this project work encourage further research to use this plant for therapeutic purposes.

Keywords: *Crateva magna*; antioxidant; antibacterial; thin layer chromatography; dichloromethane; methanol.

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List of Acronyms

C.magna	*Crateva magna*
DCM	Dichloromethane
EA	Ethyl acetate
MeOH	Methanol
TLC	Thin layer chromatography
BHA	Butylated hydroxyanisole
MHA	Mueller-Hinton agar
%	Percentage
Ml	Microliter
Mg	Microgram
ºC	Degree Celsius
ATCC	American Type Culture Collection

Chapter 1

Introduction

1.1 Rational of the work

Nature has produced medicinal substances for thousands of years, and an astonishing number of drugs have been identified from natural sources, many of which are based on their traditional medical applications. Microorganisms, on the other hand, have played a growing role in the development of antibiotics and other medications for the treatment of several major diseases.

Throughout history, humans have relied on nature to provide their basic needs, including medicines (Welz et al., 2018). Plants have been used as the foundation of traditional medical systems for hundreds and thousands of years (Mbuni et al., 2020). Plants are major producers of a wide variety of chemical substances. Some molecules have a diverse spectrum of pharmacological properties and later on, these compounds can be used in drug development.

Scientists are turning to nature to find more potent compounds as a result of the spread of various diseases (Sofowora et al., 2013). From ancient times, plants have been utilized as medicines in China, India, Bangladesh, and Greece and a large number of modern pharmaceuticals have been produced from them (Dangol, n.d., 2012). According to World Health Organization, traditional medicine is used by almost 80% of the world's population for primary health care (Z. Msomi & B.C. Simelane, 2019). The study of plants is seen to be one of the most significant and fascinating topics that should be investigated to find and create newer and safer drugs.

1.2 Aim of the study

The family of *Crateva magna* contains a wide range of pharmacologically active chemicals that are beneficial and effective against a variety of ailments, including inflammation, diarrhea, renal calculi, and dysentery (Behera et al., n.d., 2016). The key objective is to see if *Crateva magna* has antibacterial and antioxidant properties.

1.3 *Crateva magna*

Common name:

- Bengali: Borun
- English: Garlic Pear Tree
- Malayalam: Neerval

Synonyms:

- *Crateva nurvala* Buch.-Ham (Kumar et al., 2020a).

1.3.1 Plant profile

Kingdom: Plantae

Order: Brassicales

Family: Capparaceae

Genus: *Crateva*

Species: C. magna

1.3.2 Description

Crateva magna, also known as large garlic pear in English and Borun in Bengali can be up to 10 m tall (Julius, 2008). The trunk is up to 35 cm in diameter and branches can be greyish-brown, warty. It has fruits and is heavily covered with leaves during bloom. Flowers are 3-4 cm, creamy in color, polygamous, and barely scented (Behera et al., n.d., 2016). Flower stalks are 3-7 cm long. Sepals measure 2.5-3 x 1.3-1.5 cm. More than 24 stamens are present and they are 4.5-5cm long filaments. Trifoliate leaves are held on 4-12 cm tall stalks that include glands at the apex. Fruits are 4-6 x 3-5 cm, and the seeds are dark brown (Quazi et al., 2022).

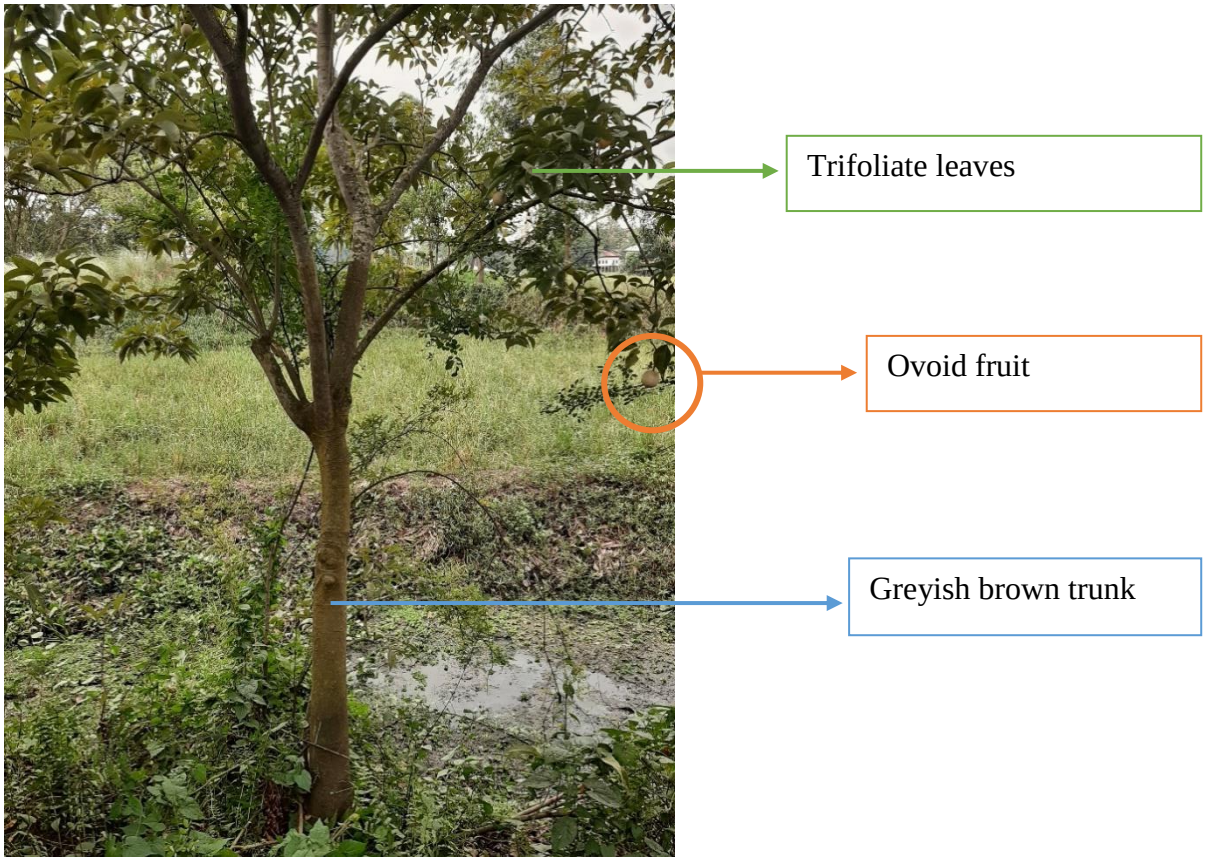
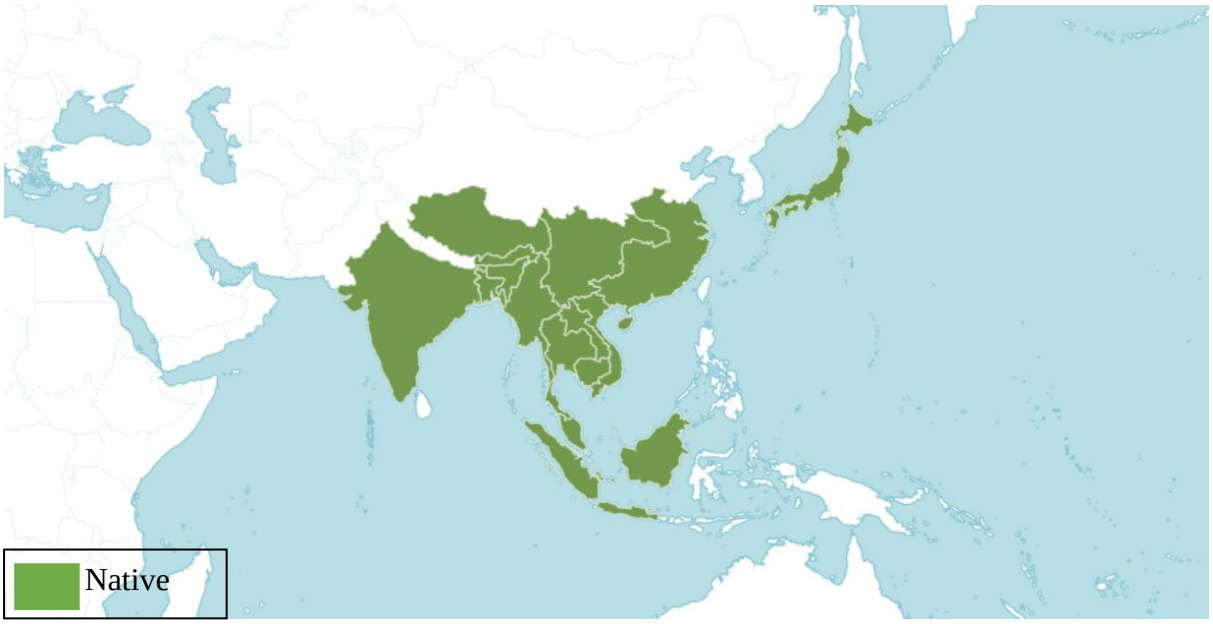


Figure 1: Crateva magna

1.3.3 Distribution

Crateva magna is native to India, China, Bangladesh, Indonesia, Malaysia, Sri Lanka, Burma, Japan, Thailand, Malaya, Cambodia, Vietnam, and China (*Crateva Magna* (Lour.) DC.: Plants of the World Online: Kew Science). This plant genus is commonly found on river banks(Kumar et al., 2020).



1.3.4 Medicinal properties

Crateva genus showed a lot of medical applications, they call fall into the following categories(*Udeh and Onoja: Analgesic Activity of Crateva Adansonii Stem-Bark Collection and Identification of Plant Material Preparation of the Plant Material Experimental Animals Determination of Free Radical Scavenging Activities of Crateva Extract Using 2, 2-Diphenyl-1-Picrylhydrazyl (DPPH) Photometric Assay Effect of Crateva Extract on Acetic Acid-Induced Abdominal Writhing in Mice*, n.d.):

- Anti-inflammatory activity
- Anti-bacterial activity

- Antioxidant activity
- Anti-diarrheal activity
- Hypoglycemic activity

A high-value, medium-sized, deciduous medicinal tree with a tropical environment, *Crateva magna* (Lour.) is found in many countries, especially in semiarid regions (Pradhan et al., 2014). It is a member of the Capparaceae family. Crateva magna leaves might even have hepatoprotective functions (Pradhan et al., 2014).

1.4 Present study protocol

The focus of this study was to observe the antibacterial and antioxidant properties of the crude extract and its different fractions. The steps in the study protocol are the followings:

- Methanol and dichloromethane extract of the powdered bark of the plant (50:50).
- Extraction and filtration.
- Solvent-solvent partitioning.
- Antibacterial activity of extract fraction.
- Antioxidant activity of extract fraction and determination of IC_{50} for extract.

Chapter 2

Material and Methods

2.1 Methods

The chemical analysis of a plant can be divided into the following major steps:

a. Collection and proper identification of the plant material
b. Preparation of plant sample
c. Extraction
d. Solvent-solvent partitioning
e. Thin layer chromatography
f. Visual analysis

2.1.1 Collection and proper identification of the plant sample

At first, with the help of a comprehensive literature review, a plant was selected for investigation and then the bark part was collected from an authentic source and was identified.

2.1.2 Preparation of plant sample

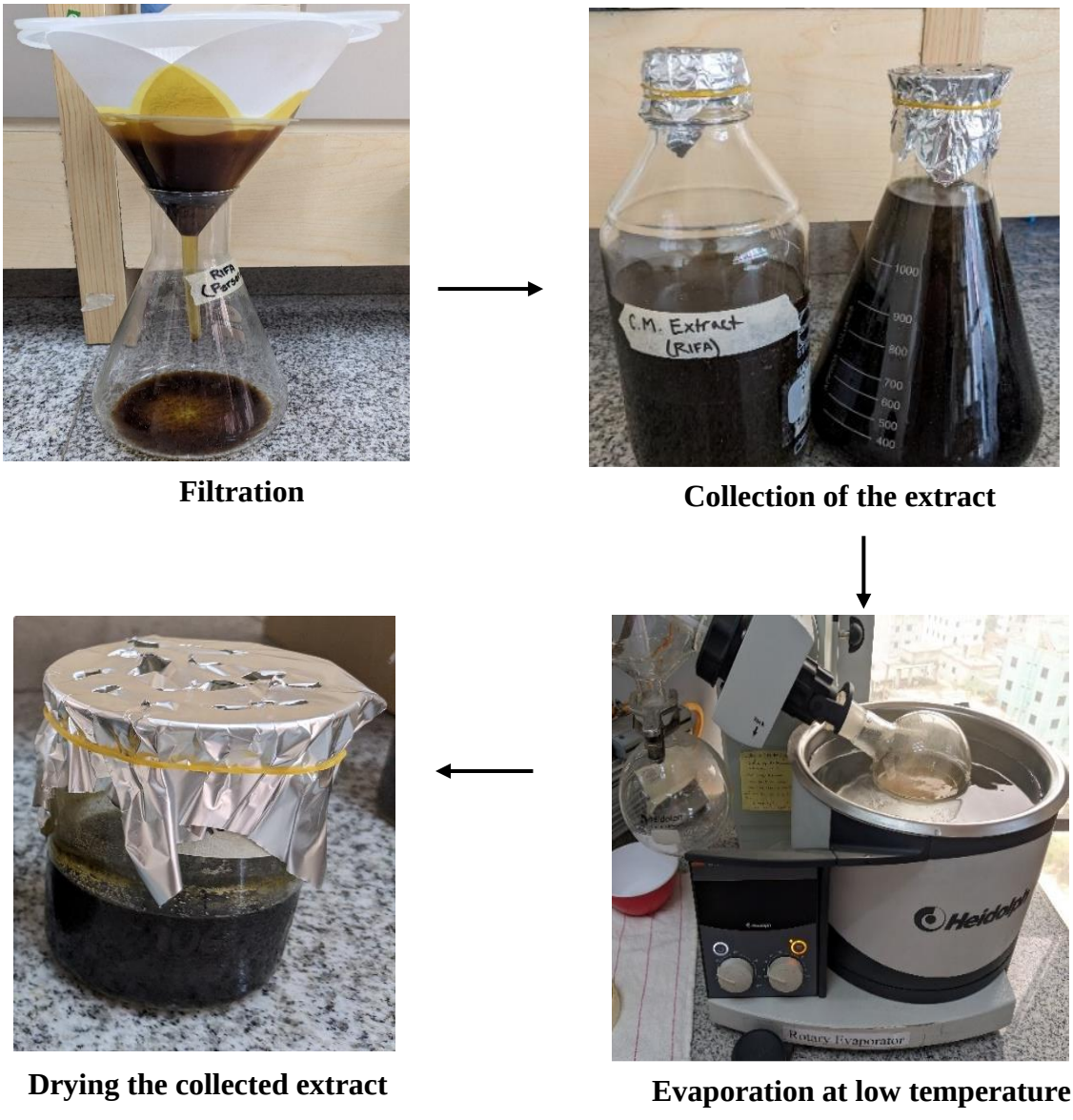
The bark part of the plant was collected in fresh condition. It was then dried to make it suitable for grinding purposes. The course powder was then stored in an air-tight container with marking for identification and kept in a cool, dark, and dry place for future use. *Crateva Magna* was obtained as a fresh bark. The bark was dried for 20 days in a row. A grinding machine was used to process the dried bark into a coarse powder.

2.1.3 Extraction

One kilogram of powdered material was soaked in dichloromethane and methanol in a flask (50:50). The container and its contents were wrapped with foil and maintained for 14 days,

shaking and stirring occasionally. After that, the entire combination went through a filtration process.

a. It was first filtered through a piece of clean, white, 100% cotton fabric. After collecting the filtrate, the residual extract was squeezed from the residue on the cloth.
b. After that, absorbent cotton was used to filter the filtrate.
c. Repeating step b with fresh cotton
d. Finally, Whatman filter paper was used to filter the filtrate. The resulting filtrate was concentrated using a rotary evaporator at 42º C.



Filtration

Collection of the extract

Drying the collected extract

Evaporation at low temperature

Figure 2: Extraction of Crateva magna

2.1.4 Solvent-solvent partitioning

The crude extract was diluted with a suitable organic solvent which was immiscible with aqueous alcohol and gently shaken in a separating funnel with a roughly similar volume of a suitable organic solvent. For the separation of the organic layer from the aqueous phase, the mixture was held undistributed for many minutes. The components of the crude extract were divided into two phases depending on their affinity for different solvents. The organic layer was separated, and the process continued three times for maximum sample extraction. Following the separating of the organic phase, the aqueous phase was extracted using a series of different organic solvents, usually of increasing polarity (such as hexane, chloroform, ethyl acetate, and methanol). Finally, the entire fraction (organic and aqueous phase) was collected and evaporated to dryness separately (Zakaria et al., 2020).

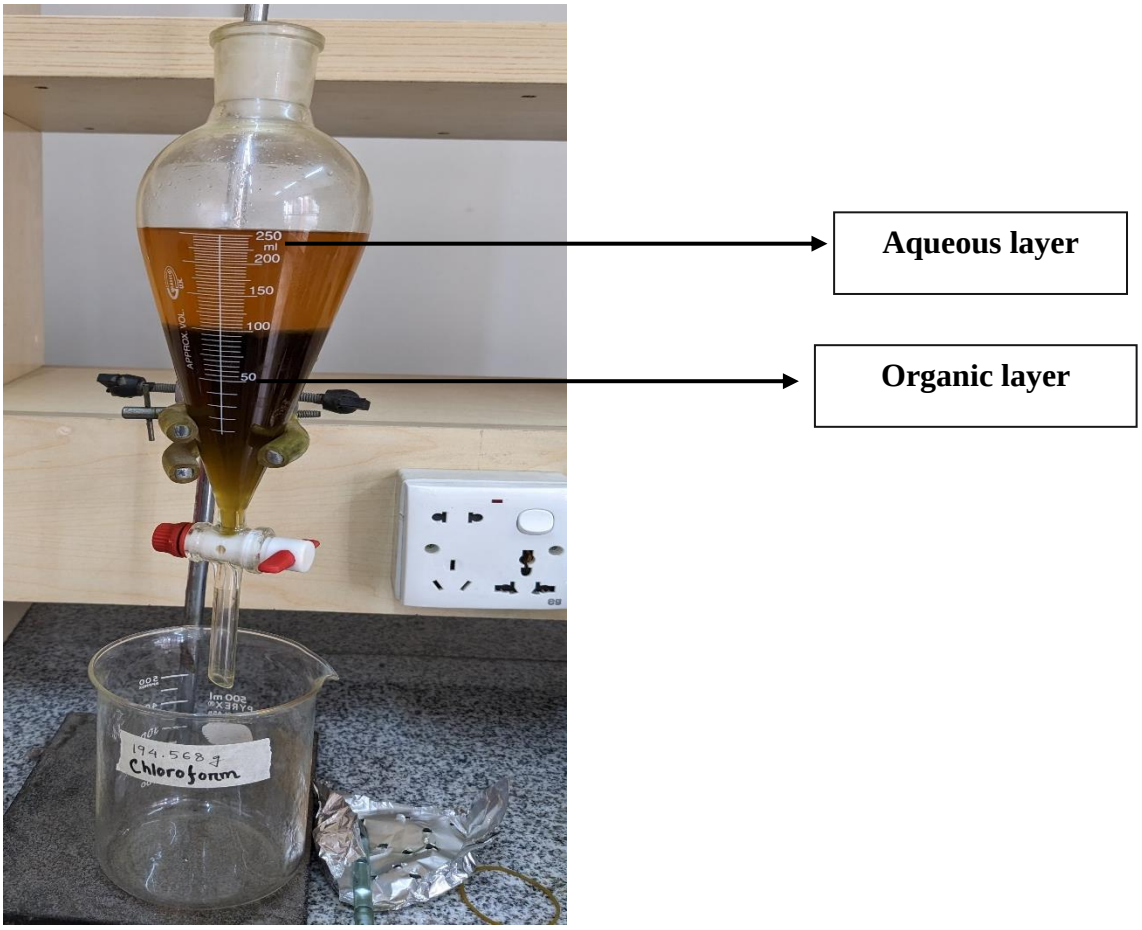


Figure 3: Partitioning of Crateva magna crude

2.1.5 Thin Layer Chromatography

Chromatographic techniques are most useful in the isolation and purification of compounds from plant extracts. Thin layer chromatographic technique was used for the initial screening of the extracts and checking the purity of compounds. Commercially available precoated silica gel plates were used. TLC tanks with airtight lids were used for the development of chromate plates. The selected solvent system (Toluene and Ethyl acetate) was poured in sufficient quantity into the tank. The tank was then made airtight and kept for a few minutes to saturate the internal atmosphere with solvent vapor. A small amount of plant extract was dissolved in a suitable solvent to get a solution. Then, a small spot of that solution was applied on the silica TLC plate and introduced into the tank. The plate was left to mature and later on, removed from the tank when the solvent front reaches a specified point. To detect the chemicals, the plates were examined under UV light of various wavelengths.

2.1.6 Visual detection

The plate was viewed visually to detect the presence of colored compounds. To detect the spot of any substance, the produced and dried plate was examined under UV light of both long and short wavelengths (254 nm and 366 nm). Under UV light, some of the compounds show luminous dots, while others appear as dark patches.

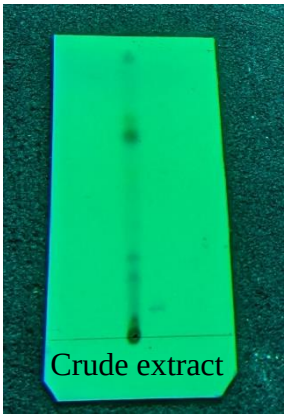


Figure 4: Visual detection of compounds in crude extract of Crateva magna by TLC

2.2 Antioxidant test: DPPH assay method

The 2,2-Diphenyl-1-picrylhydrazyl (DPPH) method, uses free radicals to evaluate a substance's capacity to act as a free-radical scavenger. It is a rapid method for measuring antioxidant capabilities (Baliyan et al., 2022).

2.2.1 Control preparation of antioxidant activity measurement

Butylated hydroxyanisole was used as a positive control. The calculated amount of BHA was dissolved in methanol to get a mother solution. Serial dilution was made using the mother solution to get different concentrations from 200 to 0.7825 µg/ml (Udeh and Onoja: Analgesic Activity of Crateva adansonii Stem-Bark Collection and Identification of Plant Material Preparation of the Plant Material Experimental Animals Determination of Free Radical Scavenging Activities of Crateva Extract Using 2, 2-Diphenyl-1-Picrylhydrazyl (DPPH) Photometric Assay Effect of Crateva Extract on Acetic Acid-Induced Abdominal Writhing in Mice, n.d.).

2.2.3 Test sample preparation

Hexane extract, chloroform extract, ethyl acetate extract, and methanol extract of *Crateva magna* were used as test samples. The calculated number of different extractives (1.6 mg for each sample) were measured and dissolved in methanol to get solutions. Serial dilution was made using the solution to get different concentrations from 200 to 0.78125 µg/ml.

2.2.4 DPPH solution preparation

2.28 mg DPPH was dissolved in methanol to get a DPPH solution having a concentration of 20 µg/ml. The solution was prepared in the amber reagent bottle and kept in a light-proof box.

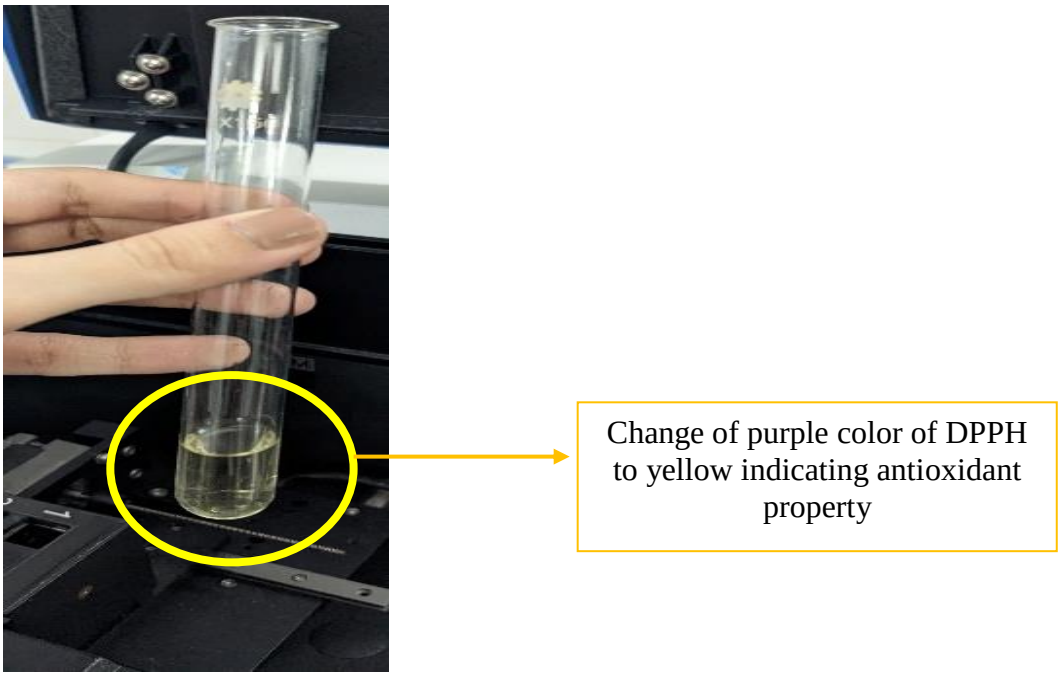
2.2.5 Assay of free radical scavenging activity

Two milliliters of methanol solution of the samples at different concentrations (200 to 0.78125 µg/ml) were mixed with 2.0 ml of a DPPH methanol solution. After 30 minutes reaction period at room temperature in a dark place the absorbance was measured at 517 nm against methanol reference by UV spectrophotometer.

Inhibition of free radical DPPH in percent (%) was calculated as follows:

(%) = (Absorbance of blank-Absorbance of sample / Absorbance of blank) X 100

Figure 5: UV spectrophotometer



Extract concentration providing 50% inhibition (IC_{50}) was calculated from the graph plotted inhibition percentage against extract concentration.

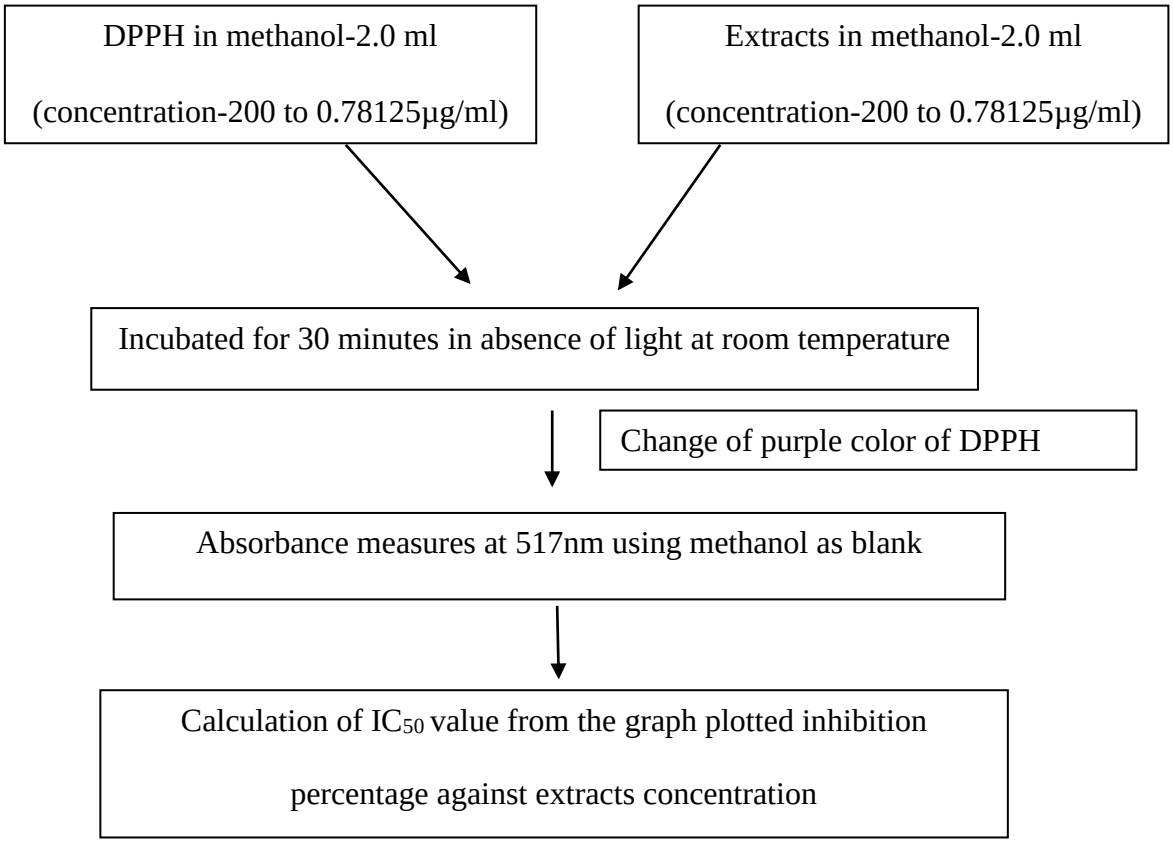


Figure 6: Schematic representation of the DPPH method

2.3Antibacterial test

Bacteria are responsible for many infectious diseases. The increasing clinical importance of antibiotic-resistant bacteria has lent additional urgency to antibacterial research. Previously different genera of *Crateva* have been tested to see the presence of antibacterial activity ("Profiling of Secondary Metabolites and Antimicrobial Activity of Crateva Religiosa G. Forst. Bark – A Rare Medicinal Plant of Maharashtra India," 2017); (Agbankpe AJ, Dougnon TV, 2016). The antibacterial screening which is the first stage of antibacterial research is performed to ascertain the susceptibility of various bacteria to any agent. This test measures the ability of

each antibacterial agent to inhibit the bacterial growth. This ability was estimated by the following method (Kirby-Bauer Disk Diffusion Susceptibility Test Protocol, 2009):

- Disc diffusion

2.3.1 Test organism

Both gram-positive and gram-negative organisms were taken for the test and they are listed in the table:

Table 1: Gram-positive and Gram-negative bacteria chosen for the antibacterial test

Gram-positive	Gram-negative
Enterococcus faecalis	*Vibrio cholerae*
Staphylococcus aureus	*Salmonella typhi*
Streptococcus pneumoniae	*Klebsiella pneumoniae*
	Shigella dysenteriae
	Pseudomonas aeruginosa
	Acinetobacter baumanii

2.3.2 Test material

Chloroform fraction of *Crateva magna*, Ethyl acetate fraction of *Crateva magna*, Hexane fraction of *Crateva magna*, and Methanol fraction of *Crateva magna* (Agbankpe AJ, Dougnon TV, 2016),(Ayodeji et al., n.d.).

2.3.3 Culture medium preparation

Mueller Hinton Agar was used for making plates on which antibacterial sensitivity tests were carried out. A nutrient agar medium was used to prepare fresh culture. To prepare the required volume of MHA and nutrient agar medium, the required amount of agar powder was taken in

a conical flask and distilled water was added to make the required volume. The agar was heated to make a clear solution. The flasks were then sterilized by autoclaving at 121ºC for this 15 mins. In an aseptic condition, the test organisms were transferred from the pure cultures to the nutrient agar medium plates by the streaking method. The inoculated plates were incubated for 24 hours at 37ºC for 18-24 hours for their optimum growth. These fresh cultures were used for the sensitivity test in the MHA medium.

2.3.4 Sterilization Procedure

To avoid any type of contamination by the test organism the antibacterial test was done in Laminar Hood and all types of precautions were highly maintained. Petri dishes and other glassware were sterilized by autoclaving at 121ºC for 15 minutes.

2.3.5 Preparation of discs

Three types of discs were used for the antibacterial test.

2.3.6 Standard discs

These were used as a positive control to ensure the activity of standard antibiotics against the test organisms as well as for comparison of the response produced by the known antibacterial agent with that of the produced test sample. In this test, the kanamycin (30µg/disc) standard was used as a reference (Parekh & Chanda, 2007).

2.3.6 Blank discs

These were used as a negative control to know if there is any antibacterial activity of the residual solvents and the filter paper (Lagnika et al., 2011).

2.3.7 Preparation of sample discs with *Crateva magna* fraction extract

The measured amount of each sample was dissolved in a specific volume of solvents to obtain the desired concentrations in an aseptic condition. Then discs were soaked with solutions of test samples so that the concentration become 100 µg/disc and dried. After that, the disc was placed into the culture plate (Muller Hinton Agar was previously inoculated with the desired concentration of bacteria). The plates were kept in an incubator at 37ºC for 18 to 24 hours.

Chapter 3

Results

3.1 Collection and proper identification of the plant sample

Crateva magna was collected from the Southern part of Dhaka in March 2023. The plant was identified and authenticated with the help of the National Herbarium.

3.1.2 Plant material preparation

The plant material was dried, cut into small pieces, and ground into powder in the grinding machine. Before grinding the pieces were dried below 50ºC for a few days. The total ground powder obtained was 1kg.

Figure 7: Powered bark portion of Crateva magna

3.1.3 Results of Partitioning

Approximately 30 gm of crude extract was obtained and selected for solvent-solvent partitioning. This partitioning was done by using four solvents and a good amount of hexane extract, a moderate amount of chloroform extract was gained. The ethyl acetate and methanol extract amounts were a bit less compared to the rest of the solvents.

Table 2: Amount and Physical characteristics of different fractions of Crateva magna

	Extract partition at different solvents			
Characteristics	Chloroform (C)	Ethyl acetate (E)	Hexane (H)	Methanol (M)
% yield	2.5 gm	0.7 gm	8 gm	0.6 gm
Color	Black green	Yellowish brown	Dark green	Reddish brown
Consistency	Firm and dense	Sticky	Firm and dense	Viscous

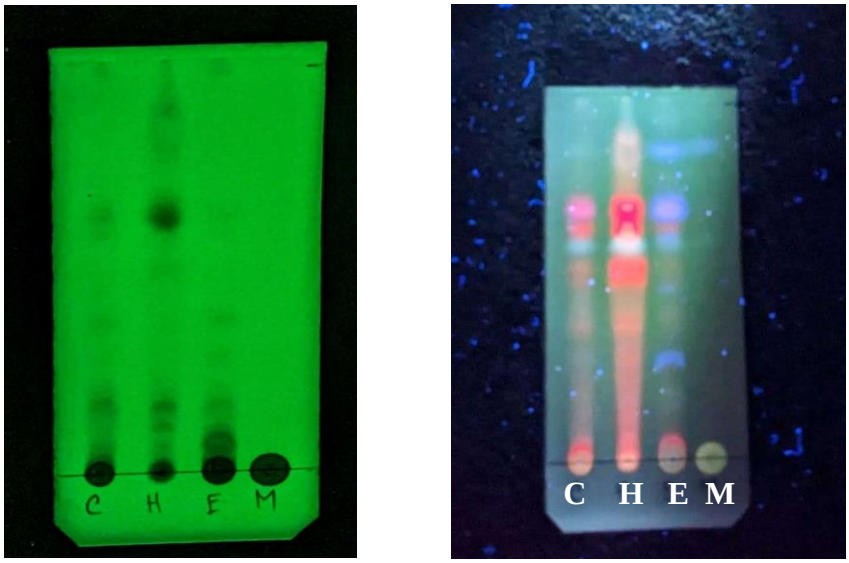


Figure 8: Visual detection of compounds after Partitioning Crateva magna extract at short and long wavelength

3.2 Results of Antioxidant Test

Plant partitioning extracts of *Crateva magna* were subjected to free radical scavenging activity.

Table 3: IC_{50} value of chloroform partition extract of C.magna

Concentration µg/ml	Absorbance of blank	Absorbance of Sample	%inhibition	50%inhibition
0.78	0.2872	0.2758	3.969359331	8.489
1.56	0.2872	0.2755	4.073816156	
3.13	0.2872	0.2637	8.182451253	
6.25	0.2872	0.2637	8.182451253	
12.5	0.2872	0.2335	18.69777159	
25	0.2872	0.2219	22.7367688	
50	0.2872	0.1941	32.41643454	
100	0.2872	0.1599	44.32451253	
200	0.2872	0.0834	70.96100279	

Table 3 shows that the highest percentage of inhibition of free radicals is at 200 µg/ml concentration of chloroform partition extract of *C.magna.* The lower the IC50 value, the more potent the substance at scavenging DPPH, and this implies a higher antioxidant activity (Olugbami et al., 2014). Hence, the 50% inhibition value is less than 10 which indicates that this particular partition extract has good antioxidant properties.

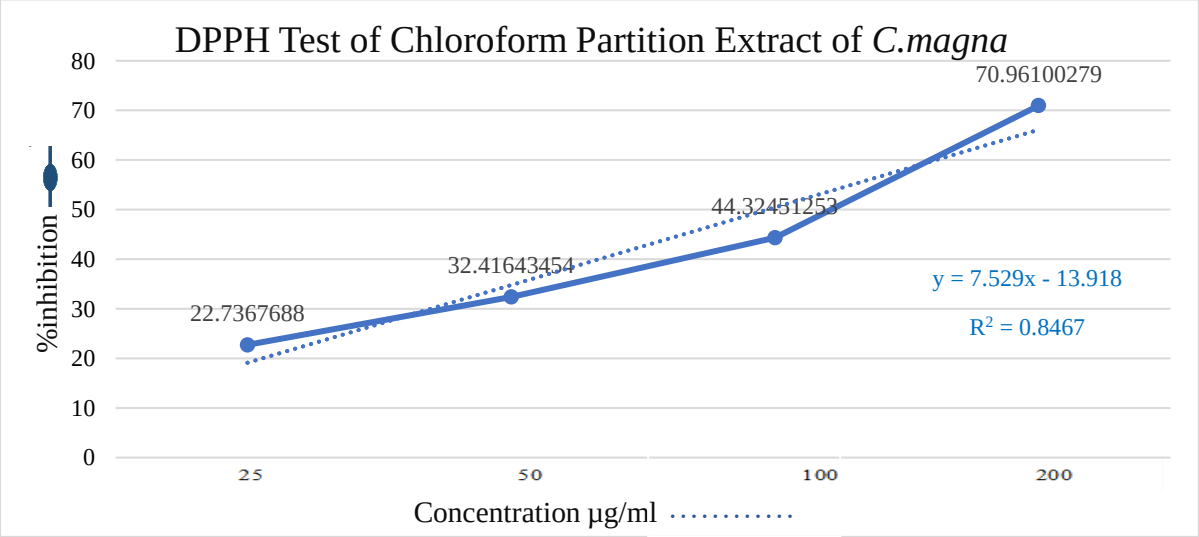


Figure 9: Chloroform partition extract of C.magna on DPPH

Table 4: IC_{50} value of Ethyl acetate partition extract of C.magna

Concentration µg/ml	Absorbance	Absorbance of Sample	%inhibition	50%inhibition
0.78	0.2872	0.2625	8.600278552	6.811
1.56	0.2872	0.2774	3.412256267	
3.13	0.2872	0.2687	6.441504178	
6.25	0.2872	0.2601	9.435933148	
12.5	0.2872	0.2235	22.17966574	
25	0.2872	0.1775	38.19637883	
50	0.2872	0.1163	59.50557103	
100	0.2872	0.0946	67.06128134	
200	0.2872	0.0725	74.75626741	

Table 4 shows that the highest percentage of inhibition of free radicals is at 200 µg/ml concentration, followed by 100 µg/ml of ethyl acetate partition extract of *C.magna*. 50% inhibition value is lesser than the previous partition extract which indicates this particular partition extract has better antioxidant property than chloroform partition extract.

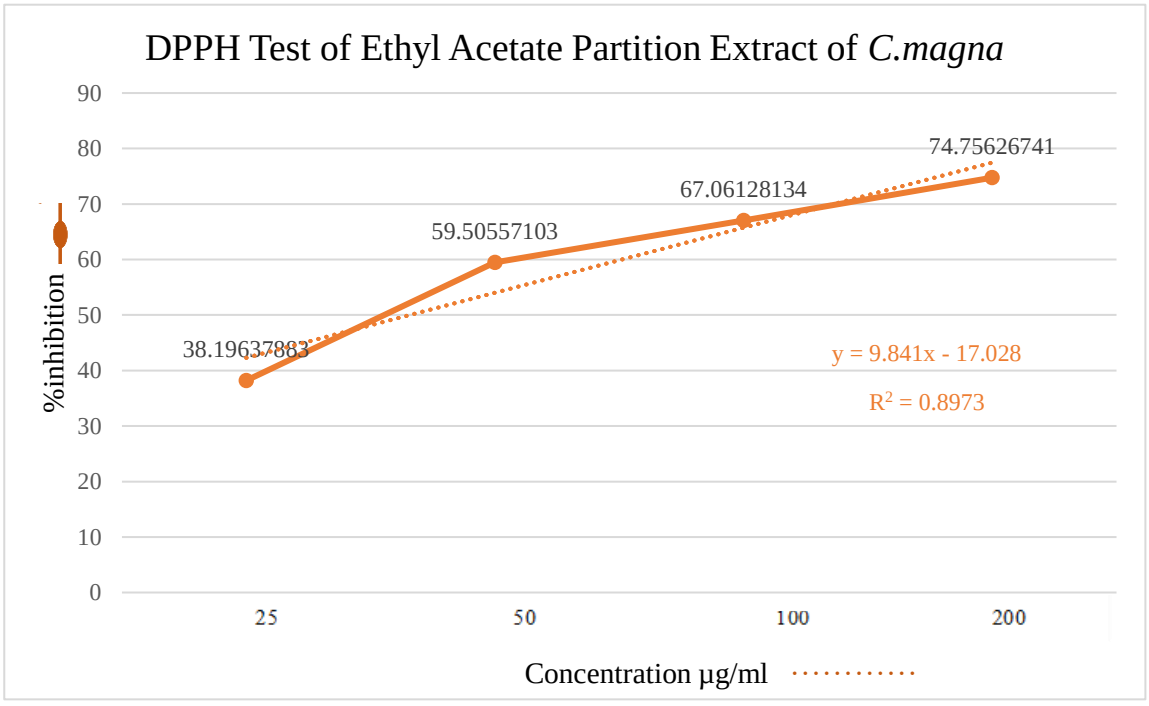


Figure 10: Ethyl acetate partition extract of C.magna on DPPH

Table 5: IC_{50} value of hexane partition extract of C.magna

Concentration µg/ml	Absorbance	Absorbance of Sample	%inhibition	50%inhibition
0.78	0.2872	0.2623	8.669916435	18.3641
1.56	0.2872	0.28	2.506963788	
3.13	0.2872	0.2721	5.257660167	
6.25	0.2872	0.2683	6.580779944	
12.5	0.2872	0.2635	8.252089136	
25	0.2872	0.2677	6.789693593	
50	0.2872	0.2565	10.68941504	
100	0.2872	0.2192	23.67688022	
200	0.2872	0.1924	33.00835655	

Table 5 shows that at maximum concentration the absorbance of the sample was 0.1924. This indicates that the 50% inhibition value is more than the previous partition extract which indicates this particular partition extract has lesser antioxidant properties than chloroform and ethyl acetate partition extract.

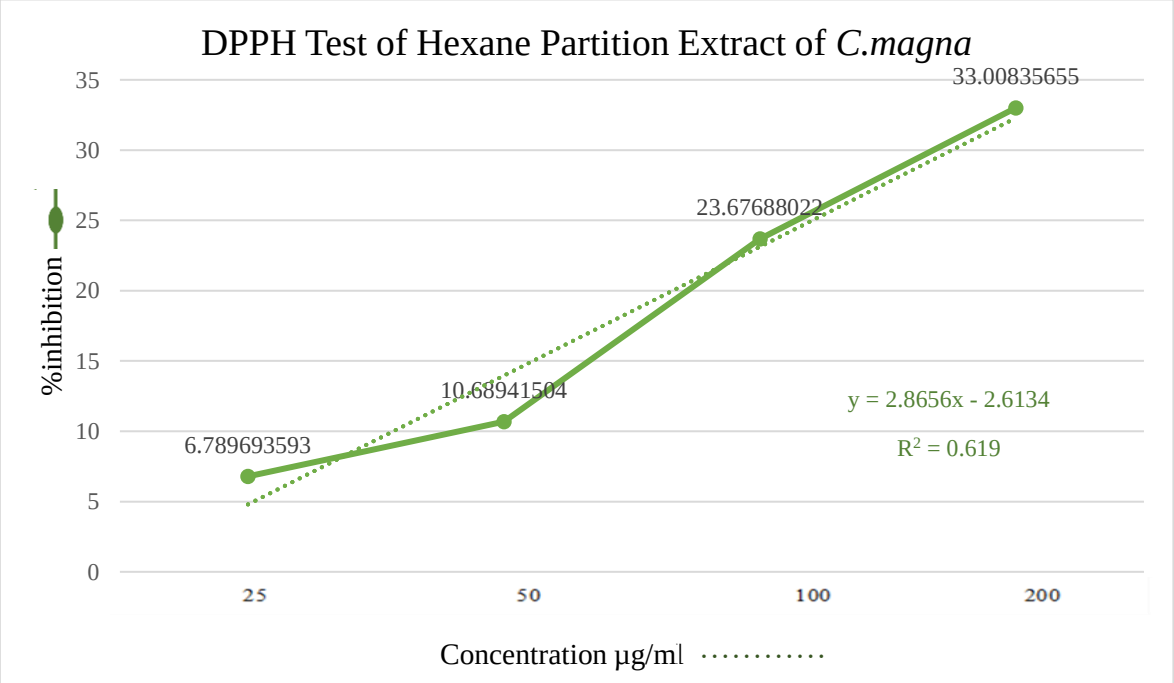


Figure 11: Hexane partition extract of C.magna on DPPH

Table 6: IC_{50} value of methanol partition extract of C.magna

Concentration µg/ml	Absorbance	Absorbance of Sample	%inhibition	50%inhibition
0.78	0.2872	0.2711	5.605849582	8.423
1.56	0.2872	0.2396	16.57381616	
3.13	0.2872	0.2235	22.17966574	
6.25	0.2872	0.243	15.38997214	
12.5	0.2872	0.2266	21.10027855	
25	0.2872	0.2142	25.4178273	
50	0.2872	0.1695	40.98189415	
100	0.2872	0.1246	56.61559889	
200	0.2872	0.1259	56.16295265	

Table 6 shows that at maximum concentration the absorbance of the sample was 0.1259. This indicates that the 50% inhibition value is less than the hexane partition extract which indicates this particular partition extract has better antioxidant properties than hexane but less antioxidant properties than chloroform and ethyl acetate partition extract.

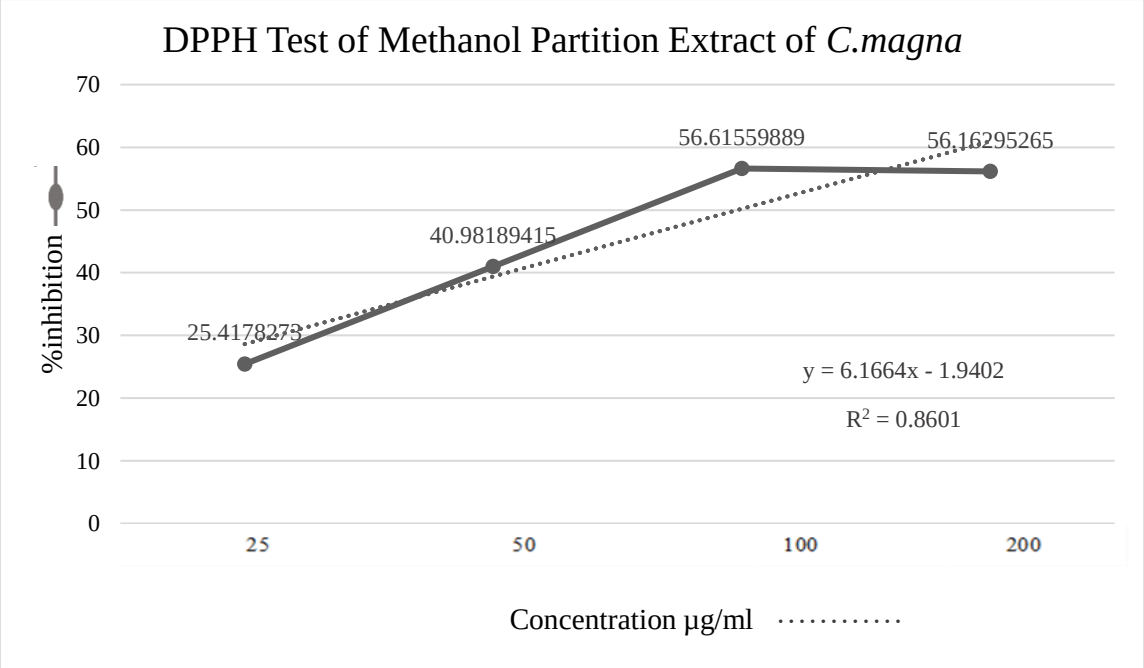


Figure 12: Methanol partition extract of C.magna on DPPH

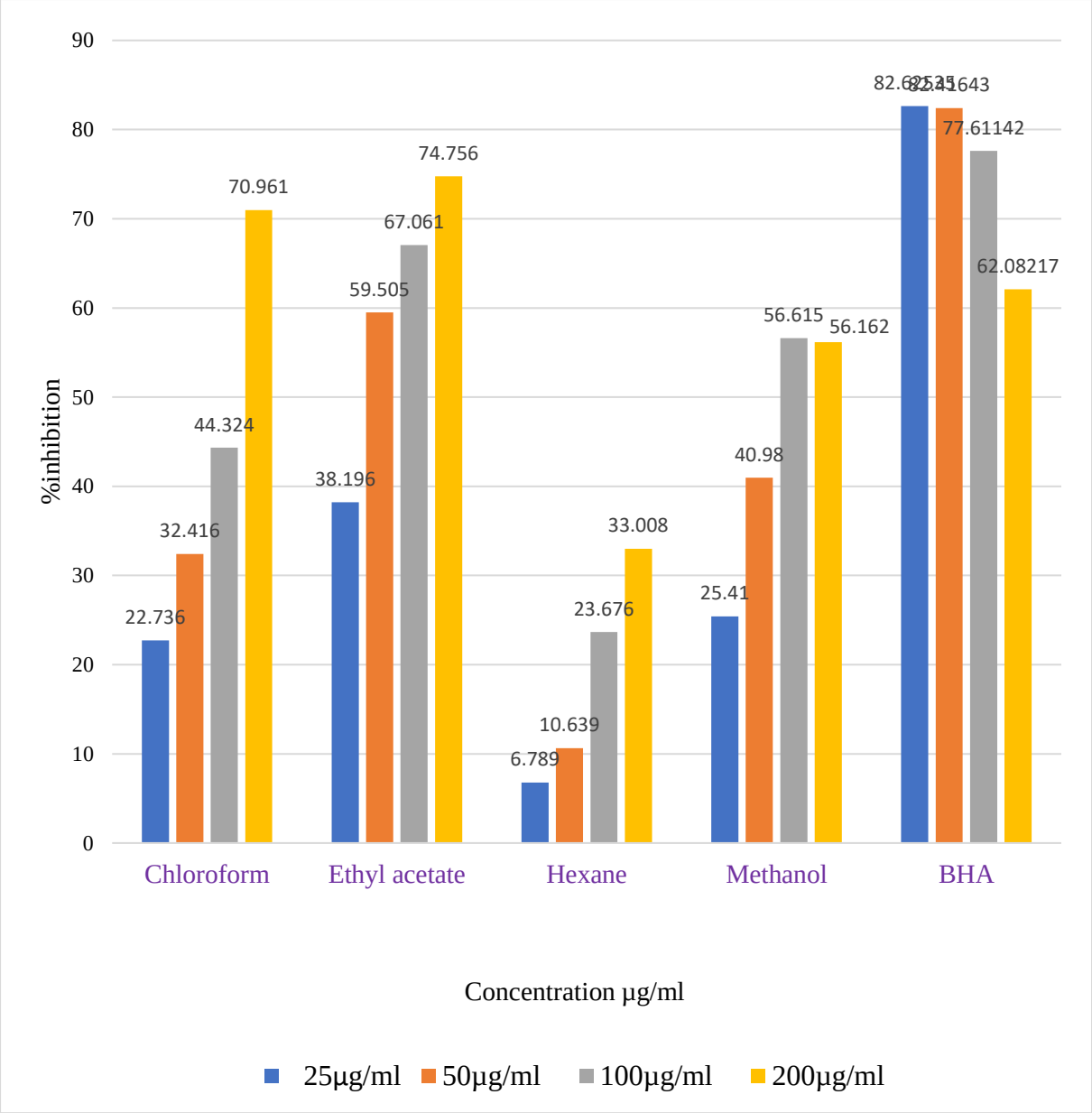


Figure 13: Inhibition of DPPH by BHA and all the partition extracts

Figure 13 shows that in the highest concentration chloroform and ethyl acetate partition extract have significant antioxidant activity. However, hexane and methanol at 200 µg/ml show 33.008 and 56.162 percent inhibition respectively which is less than the standard BHA.

3.3 Results of Antibacterial Test

Table 7: Antibacterial activity of Crateva magna extracts

Bacteria	Chloroform extract	Ethyl acetate extract	Hexane extract	Methanol Extract
Enterococcus faecalis (ATCC: 29212)	14 mm	10 mm	8 mm	-
Staphylococcus aureus (ATCC: 25923)	-	13 mm	-	-
Streptococcus pneumoniae (ATCC: 49619)	9 mm	8 mm	-	7 mm
Vibrio cholerae	15 mm	10 mm	-	-
Salmonella typhi	10 mm	14 mm	-	11 mm
Klebsiella pneumoniae	9 mm	10 mm	-	-
Shigella dysenteriae	12 mm	10 mm	-	-
Pseudomonas aeruginosa (ATCC: 27853)	9 mm	10 mm	-	-
Acinetobacter baumanii (ATCC: 19606)	10 mm	9 mm	-	-

‘-’ indicates no sensitivity

Table 7 shows that all the extracts exhibited mostly poor to mild activity against most of the test bacteria. Chloroform and ethyl acetate extract showed mild activity against most of the bacteria except *S. aureus.* However, Hexane extract showed the least activity against bacteria and methanol extract showed a 7 mm and 11 mm zone of inhibition against *S.pneumoniae* and *S.typhi*.

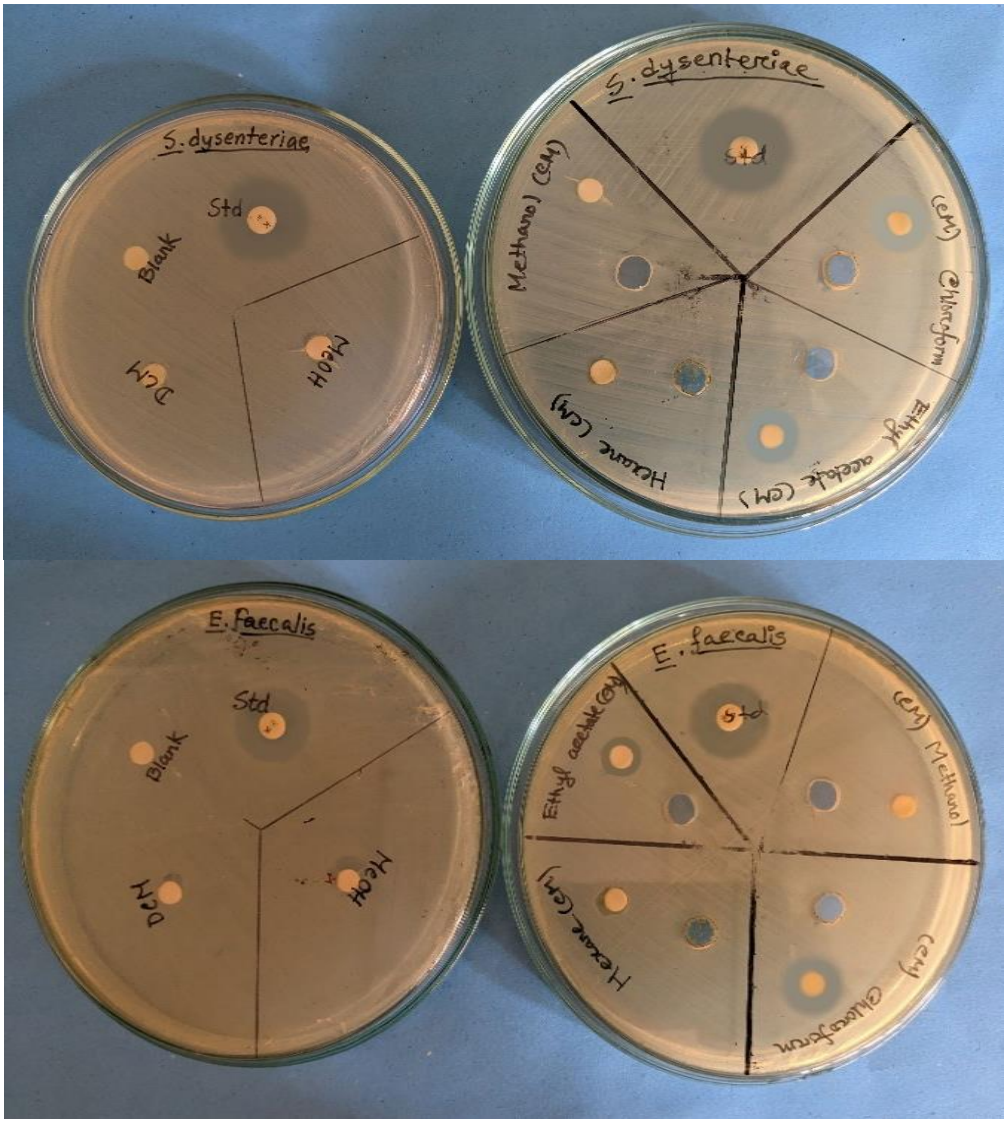


Figure 14: Antibacterial activity of Crateva magna extracts including blank, DCM, MeOH

Chapter 4

Discussion

Thin layer chromatography (TLC) is one of several chromatographic techniques that are commonly used for the isolation and purification of plant elements. The choice of technique depends largely on the solubility properties of the compounds to be separated. TLC is one of the preferred techniques for separating substances including lipids, steroids, carotenoids, simple quinones, and chlorophylls. It is also a helpful technique to gain a preliminary idea of the presence of substances in plant extract (Harborne, 1984). Visualization of partition extracts of *Crateva magna* through TLC showed that several compounds are present in the chloroform and hexane parts. These compounds might be phycobilin (blue color), cytochromes (yellow color), anthocyanins (red, violet color), and betacyanin (mauve color) present. Along with these, there are chlorophylls and carotenoids present. In TLC screening under 365 nm wavelength, one common band is noticed in both chloroform and hexane parts. Hence, it is possible to isolate pure compounds from the chloroform and hexane part of the *Crateva magna* extract.

It is quick to test the antioxidant properties of compounds using the free radical DPPH technique, which is frequently used to assess their capacity to act as free-radical scavengers and hydrogen providers (Roy et al., 2018). The DPPH test depends on DPPH, a stabilized free radical, being eliminated. DPPH is a stable free-radical molecule that has a dark violet color. It is a well-known antioxidant and radical test in particular. The DPPH radical initially displays a dark violet hue in solution; however, after reduction and transformation into DPPH-H, it becomes colorless or light yellow (Baliyan et al., 2022). Plant extracts of *Crateva magna* showed significant scavenging activity. Chloroform, ethyl acetate, hexane, and methanol fraction of *Crateva magna* shows potent antioxidant activity. In chloroform partition of *Crateva magna* extract at 200 µg/ml showed an absorbance of 0.0834 which is near the

reference (MeOH). In addition, the 50% inhibition is less than 10 indicating the extract has good antioxidant activity. Furthermore, in ethyl acetate partition extract at 100µg/ml and 200µg/ml the absorbance at 517 nm was 0.0946 and 0.0725 were also close to the reference. Methanol partition extract showed 8.423 in 50%inhibition which is also less than 10. However, hexane partition extract showed 18.3641 in 50%inhibition and comparatively, it has less antioxidant activity than chloroform, ethyl acetate, and methanol partition extract. Hence, it can be said that there is a significant antioxidant property in *Crateva magna* chloroform, ethyl acetate, and methanol extract.

Four extracts of *Crateva magna* were tested for antibacterial activity against several gram-positive and gram-negative bacteria. Standard disc kanamycin was used for comparison purposes (Weinstein & Clinical and Laboratory Standards Institute, n.d.). Hexane partition extract only showed a little activity against *Enterococcus faecalis* and methanol partition extract showed activity against *Streptococcus pneumoniae* and *Salmonella typhi*. The chloroform and ethyl acetate extracts exhibited mostly mild activity against most of the test bacteria. In chloroform, partition extract the highest zone of inhibition was 15 mm against *V.cholerae* followed by *E.faecalis*, and *S.dysenteriae*. In the case of ethyl acetate extract, 14 mm was the highest zone of inhibition against *S.typhi*. This positive mild result suggests that chloroform and ethyl acetate partition extracts may contain antibacterial metabolites.

Conclusion

Plants are a significant source of medication and have a significant impact on global health. It has long been known that medicinal herbs or plants can be a valuable source of therapies. Two-thirds of the world's population, or many countries, rely on herbal medicine as their primary form of healthcare. This is because they are better suited to the human body, adaptable, and have fewer negative side effects (Garg et al., n.d.; Sofowora et al., 2013). The chloroform, ethyl acetate, hexane and methanol partition extracts of *Crateva magna* showed significant antioxidant activity. Chloroform and ethyl acetate partition extract showed mild antibacterial effects against several bacteria. Further analysis should be done on whether it might have a better antibacterial activity that presents antibiotics and those which have already resistant. So, considering the potential bioactivity, the plant can be further studied extensively to find out their unexplored efficiency and to rationalize their uses as traditional medicines.

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