Antibacterial Activity of Papaya Latex of Selected Geographic Location against *Staphylococcus aureus, Streptococcus pyogens, Salmonella typhi,* and *Pseudomans aeruginosa*

Anshu Kumar Singh and Shailesh Solanki

Research Journal of Agricultural Sciences
An International Journal

P- ISSN: 0976-1675
E- ISSN: 2249-4538

Volume: 13
Issue: 01

Res. Jr. of Agril. Sci. (2022) 13: 240–245

CARAS

Res. Jr. of Agril. Sci. (Jan-Feb 2022)
13(1): 240–245

ISSN: 0976-1675 (P)
ISSN: 2249-4538 (E)

www.rjas.org

Full Length Research Article

Antibacterial Activity of Papaya Latex of Selected Geographic Location against *Staphylococcus aureus, Streptococcus pyogens, Salmonella typhi,* and *Pseudomans aeruginosa*

Anshu Kumar Singh[1] and Shailesh Solanki*[2]

Received: 22 Nov 2021 | Revised accepted: 24 Jan 2022 | Published online: 16 Feb 2022

A B S T R A C T

Today's treatment of diseases is highly costly due to the advancement of techniques along with the problem as most of the drugs produced in the pharmaceutical industry are on large scale at a high cost. Conventionally, many people cannot afford allopathic drugs and eventually suffer from harmful diseases that lead to their death. Second, allopathic drugs also have various adverse health effects that can lead to other infectious diseases occurrences in parallel with the current disease. Hence, various plants and their beneficial active compound scan can be used to treat various bacterial diseases, with low-cost availability, and problems like adverse reactions and bacterial drug resistance can be avoided. The present study represents latex of *Carica papaya* showing good and potential antibacterial activity against *S. aureus*, *S. pyogens*, *S. typhi* and *P. aeruginosa*. The most harmful and disease- causing bacteria have been shown to be affected by these plants. The active components of papaya latex have high effective antimicrobial activity. But this antibacterial property has been shown to vary to a great extent when compared to the latex of papaya collected from various different geographical locations. The latex of Papaya has antibacterial, antifungal and anti-inflammatory properties, which are highly beneficial for any kind of bacterial as well as fungal disease. Therefore, papaya latex is used to treat various superficial mycosis and bacterial infections. This research comparative study is carried out by collecting the *C. papaya* latex sample from Udaipur (Rajasthan), Manipur, Nainital (Uttarakhand) & Greater Noida (Uttar Pradesh).

***Key words*:** Papaya latex, Medicinal plants, Phytochemical properties, Geographical locations, Antimicrobial properties, Extract preparations, Minimum inhibitory concentration

Infectious disease in this modern world is the leading cause of morbidity and mortality among people mainly in developing countries due to poor hygiene habits and the inaccessibility of food, nutritional food. Due to this mentioned reason the various bacteria infect the immunocompromised host especially children and old people. For the treatment of such infections, huge use of antibiotics bacteria develops antibiotic resistance and host suffering with hypersensitivity and various other allergic conditions. Therefore, we need to focus on other treatment options that are effective and safe for use. The extracts of various plants are used in various pharmaceuticals [1]. Ayurvedic and Unani medicine science for the preparation of drugs to treat various major and minor diseases. The use of plant extracts due to their known antimicrobial properties is of great significance in the treatment of various microbial infections in the past decades. Various research has been conducted to show the effect of medicinal plants in the treatment of various microbial diseases [2]. Papaya is the best fruit known for its nutritional and medicinal value from ancient times. It is a best source of vitamin, vitamin A, vitamin E, magnesium, potassium, B vitamin pantothenic acid, folate and other fiber. Papaya also contains proteolytic enzymes like papain and chymopapain that are similar to the digestive enzymes of human body pepsin and are used to break and denature the essential protein and enzymes of bacteria that are why it contains antibacterial activity to kill or inhibit the growth of selected bacteria.

Carica papaya is also called papaw and pawpaw. It belongs to the Caricaceae family. It originates from the tropical regions of America and Central America; papaya is found throughout the world including India. Papaya is small sparsely branched tree that grows with a single stem that is 16-35 feet long. Papaya leaves are spiral that are 20-25 inches in diameter. All parts of papaya have latex. Papaya is dioecious and its flowers have 5 parts and that is, highly dimorphic male flowers have stamens that fuse with petals where female flowers have an ovary and 5 contracted petals connected to the base. The

* **Anshu Kumar Singh**
✉ anshubmlt1993@gmail.com

[1] Department of Microbiology, Research and Innovation Centre, Noida, International University, Greater Noida, Uttar Pradesh, India

[2] Department of Microbiology, Research and Innovation Centre, Noida International University, Greater Noida, Uttar Pradesh, India

papaya plant grows as male, female, and hermaphrodite. This plant grows fast and produces fruit in 3 years [3]. Papaya latex has several active compounds chymopapain, phenol, tannin, flavonoids, saponin, glycosides, and papain that are important proteolytic enzymes [4] that have a marked effect against bacteria to inhibit the growth of bacteria and kill the bacteria.

MATERIALS AND METHODS

Sample collection of plants

Latex of *Carica papaya* collected from Udaipur (Rajasthan), Manipur (MR), Nainital (Uttarakhand) and Greater Noida (Gautam Budh Nagar, U.P.). In the selected geographical location, the temperature, the percentage of rain and other environmental factors are varied. The collection details of latex and their various conditions is shown below in the (Table 1).

Specimen validation and authentication

The botanical validation and authentication were performed by Dr. Shailesh Solanki, Department of Microbiology and Agriculture, Faculty of Sciences, Noida International University, Uttar Pradesh.

Extract preparation

Ethanol, Methanol, and chloroform are selected as solvents for extract preparations. The Latex from different geographical locations is collected in dry sterile container. The latexis allowed to dry in Hot Air oven at 30-35°C for 16-24hours.All dried latex is grind separately using as mixer grinder and the powdered latex is stored in air tight sterile containers. Now the powdered latex is extracted with ethanol, methanol and chloroform in 1:10 ratio [5] and then the extracts are allowed to evaporate the alcoholic contents at room temperature for 16-18 hours and the extracts are filtered with Whatmann Filter Paper No-1 and the extracts obtained are stored in refrigerators at 4°C until use.

Table 1 Collection details of latex and their various conditions

S. No.	Location	State	Collection date	Temp.	Rainfall percentage
1	Udaipur (RJ)	Rajasthan	15-Mar-2021	22-41°C	27
2	Manipur (MR)	Manipur	28-Mar-2021	17-24°C	40
3	Nainital (NT)	Uttarakhand	07-Oct-2019	08°-19C	43
4	Greater Noida (GN)	Uttar Pradesh	17-Sep-2019	20-38°C	25

Qualitative phytochemical tests

Various tests are conducted to check the presence of Tannin, Saponin, Papain**,** Flavonoid, Chymopapain, Steroid, Phenol and Glycosides according to standard test methods.

Sample Selection of S. aureus, S. pyogens, S. typhi and P. aeruginosa

The Bacterial species of *S. aureus (ATCC43300)* and *S. pyogens* (19615) are collected using Culture and Subculture techniques in Nutrient broth and Nutrient Agar from SRL Laboratories Noida, UP, and the bacterial samples of *S. typhi (ATCC 6539)* are obtained by growing the microbes on XLD agar and the *P. aeruginosa specimens (ATCC 15442)* are obtained by growing the microbes on LB broth and agar, from SRL Laboratories Noida,U.P. Three commonly used antibiotics streptomycin (X-GEN, 1000 mg), azithromycin (500 mg) and tetracycline (200 mg) are used as a control in antimicrobial testing.

Inoculum preparation

The bacterial strains of *S. aureus* and *S. pyogens* are grown on Nutrient Agar and blood Agar, *S. typhi* on XLD agar and *P. aeruginosa* in LB broth and agar (Himedia, India) at 37°C for 24-36 hours. The stock culture is keptin the refrigerator at 4°C.

Antimicrobial testing- agar diffusion method

To check the antimicrobial / antibacterial activity [6] of the prepared latex extract of *C. papaya* different culture media are used. Nutrient agar is used for *S. aureus*, and blood agar is used for *S. pyogens*, XLD agar for *S. typhi*, and Luria Bertani agar for *P. aeruginosa*. The dried Latex extracts 200mg is dissolved again in 10ml of ethanol the contents are filtered by Whatmann Filter Paper No-1. Now the discs (6mm in diameter) 100-200µl of bacterial Suspension, having $1.6*10^6$ $CFUmL^{-1}$ was spreaded. The disc was loaded with 40µL plant extracts of the concentration (10mg/mL) on the agar plates. With the same procedure filter paper discs loaded with 5µL of 10 mg / mL antibiotic solutions were used as a positive control and as negative control solvent were used. The plates are now incubated at 37°C for 24-48 hours after which the inhibition zone is measured in mm.

Minimum inhibitory concentrations

When we tested antimicrobial / antibacterial activity along with Latex extracts of different geographical locations by agar diffusion method, the marked antibacterial activity. Now, by three-fold dilutions different concentrations of papaya extract (0.50, 1.50, 4.5,13.5 mg / mL are prepared by dissolving separately 100 mg of papaya latex in 5 mL of Methanol, Ethanol, and chloroform and the MIC for antibacterial activity papaya latex extracts. The medium is prepared sterile and poured in sterile Petri plates and spread with 100µL of each bacterial suspension. The filter paper discs are loaded with 40µL of each plant extracts and placed in agar plates. Incubate the plates at 37°C and the zone of inhibition is measured in mm for each extract that shows antibacterial activity.

Statistical analysis

During the work, all lab work is performed in triplicate manner the data were recorded as means $\pm$ standard deviation (SD). One way ANOVA test is also performed on all statistical data where $p<0.5$ is taken as Significant.

RESULTS AND DISCUSSION

Extraction process

Phytochemical study of papaya latex from selected geographical locations shows the presence of various active compounds. According to this study, latex from all region have papain, saponin, glycosides, and chymopapin [7] in high concentrations along with Ethanol and Methanol, less with chloroform where Tannin, Flavanoid, Phenol and Steroid in less concentrations with all extracts. These phytochemicals have various biological properties that is why they are used for the treatment of various diseases [8] and other medicinal purposes. Ethanol, methanol, and chloroform have a property in reacting with plant specimens and the active compounds drawn from the specimen plants. Papain and Chymopapain have proteolytic properties to break down the cell membranes of bacteria and

other proteinious elements that show antimicrobial activity. Phenolic compounds also have bacteriostatic and bactericidal properties. Flvanoids also have marked antimicrobial properties against a wide range of bacteria [9].

Fig 1 Display papaya latex extracts collected from different geographical locations and prepared with three solvents. As per the pictures RJ-Udaipur (Rajasthan), MR-Manipur, NT-Nainital (Uttarakhand) and GN-Greater Noida, E-Ethanol, M-Methanol, and C-Chloroform. Due to the different concentrations of active compounds present in papaya latex, slight color change is observed after the extract preparations

Phytochemical qualitative assay

Data depicted in (Table 1) represents the results of the phytochemical analysis of *C. papaya* selected from Udaipur (Rajasthan), Manipur, Nainital (Uttarakhand) Greater Noida (UP), where E-Ethanol, M-Methanol, C-Chloroform and RJ, MR, NT, GN. Symbols show (-) Absent, (+) 10-30% Slightly Present, (++) 30-60% Moderate Present, (+++) 60-90% Highly Present.

Antimicrobial activity-agar disc diffusion test

Papaya extracts from five different geographical locations are tested against the two Gram positive bacteria *S. aureus* and *S. pyogens* by the disc diffusion method. Antibiotic sensitivity of microbes is detected by the disc diffusion method against commercial antibiotics. The study shows that the antimicrobial properties of the ethanolic extracts are very high compared to the methanolic and chloroform extracts, where the concentration of the extracts is 20 mg / ml It clearly shows that the presence of active compounds such as tannin, flavonoid, papain, chymopapain have marked antimicrobial properties [10]. Methanol and chloroform extracts show less antimicrobial properties due to fewer active compounds present and dissolve in these extracts, a more polar solvent was shown to be very effective in extracting more organic and inorganic compounds than less polar solvents. The presence of active biological compounds also differed due to differences in geographical locations. Latex collected from Manipur and Nainital (Uttarakhand) show the better antimicrobial activity compared to the latex collected from other geographical locations, so minimum inhibitory concentration tests of extracts are performed.

Various previous research articles indicate that the biological compounds of various plants have a significant effect against disease causing Gram positive bacteria such as *S. aureus* and *S. pyogens.* The antimicrobial / antibacterial activity of different biological active compounds has a different mechanism, such as Gram positive bacteria have a thick layer of peptidoglycan in their cell wall that provides mechanical strength to bacteria and also provides resistance [11] power to resist various mechanical, chemical and physical stress. Now in the modern world due to the use of more antibiotics, bacteria develop resistance to tolerate the effect of various antibiotics as well as adverse effects are more common due to the regular use of antibiotics, here natural biological compounds become a better choice to treat various major and minor diseases.

Table 1 Qualitative analysis results of ethanol, methanol, chloroform papaya latex extracts

Phytochemical tests	RJ-E	RJ-M	RJ-C	MR-E	MR-M	MR-C	NT-E	NT-M	NT-C	GN-E	GN-M	GN-C
Papain	+ +	+ +	+	+ + +	+ +	+ +	+ + +	+ + +	+	+	+	+
Tannin	+	+	-	+	+	+	+	+	+	+	+	-
Flavonoid	+	-	-	+	+	+	+	+	-	-	-	+
Saponin	+	-	-	+	+	+	+ + +	+ + +	+ +	+ +	+ +	+ +
Phenol	+	+	+	++	+	+	+ +	+ +	+ +	+	-	-
Glycosides	+ +	+	++ +	++ +	++ +	++ +	++ +	++ +	++ +	++ +	++	++
Chymopapain	+ +	+ +	++ + +	++ + +	++ +	++ + +	++ + +	++ + +	++ +	++ +	++ +	++ +
Steroids	+	+	--	++	++	++	++ +	++ +	+ +	++	+-	--

Minimum inhibitory concentrations

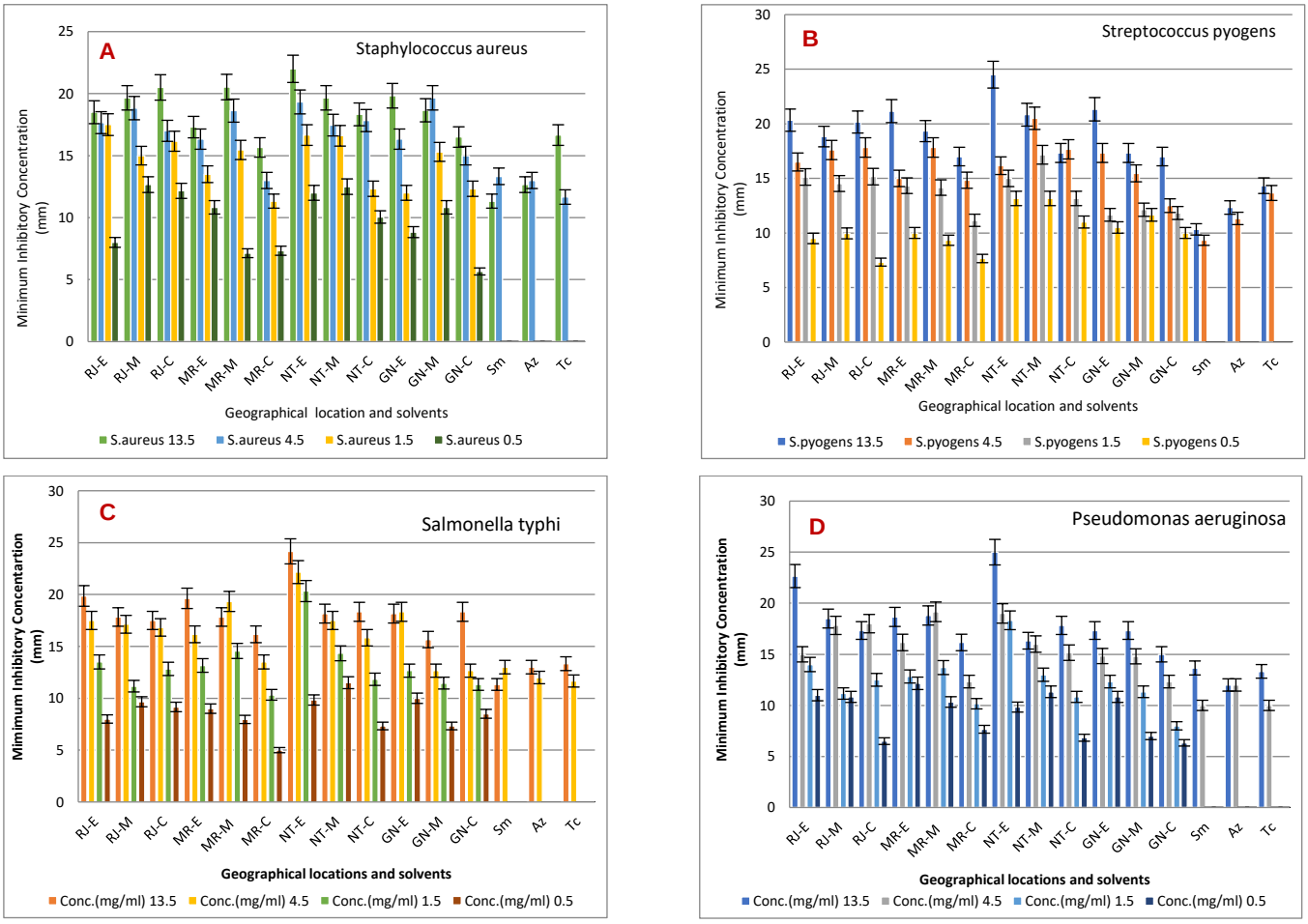
According to the Disc-Diffusion method from the graph all extracts ethanol, methanol, and chloroform have antimicrobial (antibacterial) activity against *S. aureus, S. pyogens, S. typhi* and *P. aeruginosa*. The MIC value is calculated in µg/mL. In extracts, the extracts of papaya latex from Nainital (U.K) have a better antimicrobial activity against selected microbes compared to the extracts of different geographical locations. Also, the ethanolic extracts of papaya latex have better antimicrobial activity against selected microbes compared to other extracts. MIC is reported that the *C. papaya* extracts improved microbial inhibition. Data in (Table 2) shows the inhibition Zone distance (in mm) of Papaya latex extracts of ethanol, methanol, and chloroform and standard antibacterial agents against selected bacteria. E-Extracts, Ab-Antibiotics, E-Ethanol, M-Methanol, C-Chloroform and RJ-Udaipur (Rajasthan), MR-Manipur, NT-Nainital, GN- Greater Noida, Sm-Streptomycin, Az-Azithromycin, Tc-Tetracyclin. Functions with a low MIC value compare with standard antimicrobial agents. Streptomycin, Azithromycin, and Tetracyclin have a satisfactory performance high at 13.5 and low at 0.50 concentrations to show

antimicrobial activity. Bacterial DNA is the target of this experiment to determine the antibacterial activity that extracts have. Extracts inhibit the production of DNA Gyrase and DNA Topoisomerase to inhibit DNA replication, as well as binary fission [12] to inhibit or kill microbes. Here, all the extracts have significant antimicrobial activity selected from different geographical locations against *S. aureus, S. pyogens, S. typhi,* and *P. aeruginosa*.

Table 2 Minimum inhibitory concentration of ethanol, methanol and chloroform extracts

	S. aureus	*S. pyogens*	*S. typhi*	*P. aeruginosa*
E/ Ab	Concentrations of Extracts and Antibiotics in (mg/mL) : Zone of Inhibition ± Standard Deviation (mm)			
RJ-E	13.5 : 18.50 ± 1.80	13.5 : 20.33 ± 1.52	13.5 : 19.86 ± 2.01	13.5 : 22.66 ± 4.16
	4.5 : 17.66 ± 4.04	4.5 : 16.50 ± 2.50	4.5 : 17.50 ± 1.50	4.5 : 15 ± 1
	1.5 : 17.50 ± 3.04	1.5 : 15.13 ± 1.20	1.5 : 13.50 ± 3.27	1.5 : 14 ± 3.60
	0.50 : 8 ± 7.21	0.50 : 9.50 ± 0.50	0.50 : 8 ± 7.21	0.50 : 11 ± 2.64
MR-E	13.5 : 17.30 ± 1.91	13.5 : 21.16 ± 6.04	13.5 : 19.63 ± 2.36	13.5 : 18.66 ± 1.15
	4.5 : 16.33 ± 2.51	4.5 : 15 ± 1	4.5 : 16.16 ± 1.75	4.5 : 16.16 ± 1.04
	1.5 : 13.50 ± 3.27	1.5 : 14.33 ± 4.04	1.5 : 13.16 ± 4.25	1.5 : 12.83 ± 2.46
	0.50 : 10.83 ± 2.75	0.50 : 10 ± 1.32	0.50 : 9 ± 1	0.50 : 12.16 ± 2.02
NT-E	13.5 : 22 ± 2	13.5 : 24.50 ± 3.04	13.5 : 24.16 ± 2.25	13.5 : 25 ± 3
	4.5 : 19.33 ± 3.05	4.5 : 16.16 ± 2.02	4.5 : 22.16 ± 2.75	4.5 : 19 ± 3.60
	1.5 : 16.66 ± 3.05	1.5 : 15 ± 1	1.5 : 20.33 ± 4.50	1.5 : 13.83 ± 3.40
	0.50 : 12 ± 2	0.50 : 13.16 ± 3.68	0.50 : 9.83 ± 2.36	0.50 : 9.83 ± 2.36
GN-E	13.5 : 19.83 ± 1.89	13.5 : 21.33 ± 3.05	13.5 : 18.16 ± 2.56	13.5 : 17.33 ± 3.78
	4.5 : 16.33 ± 2.51	4.5 : 17.33 ± 3.21	4.5 : 18.33 ± 2.08	4.5 : 14.83 ± 1.25
	1.5 : 12 ± 1.80	1.5 : 11.66 ± 1.52	1.5 : 12.66 ± 2.51	1.5 : 12.33 ± 2.08
	0.50 : 8.83 ± 0.76	0.50 : 10.50 ± 1.80	0.50 : 10 ± 2.64	0.50 : 10.83 ± 1.60
RJ-M	13.5 : 19.66 ± 1.52	13.5 : 18.83 ± 2.25	13.5 : 17.83 ± 1.25	13.5 : 18.50 ± 1.80
	4.5 : 18.83 ± 1.25	4.5 : 17.66 ± 2.92	4.5 : 17.13 ± 2.50	4.5 : 17.83 ± 2.92
	1.5 : 15 ± 1.50	1.5 : 14.53 ± 1.28	1.5 : 11.16 ± 2.46	1.5 : 11.16 ± 2.46
	0.50 : 12.66 ± 4.50	0.50 : 9.96 ± 2.23	0.50 : 9.66 ± 2.08	0.50 : 10.83 ± 1.89
MR-M	13.5 : 20.53 ± 1.28	13.5 : 19.33 ± 2.08	13.5 : 17.83 ± 1.75	13.5 : 18.80 ± 1.31
	4.5 : 18.63 ± 1.18	4.5 : 17.83 ± 2.92	4.5 : 19.33 ± 2.08	4.5 : 19.16 ± 0.76
	1.5 : 15.46 ± 1.30	1.5 : 14.16 ± 2.02	1.5 : 14.56 ± 1.72	1.5 : 13.70 ± 3.55
	0.50 : 7.13 ± 6.40	0.50 : 9.33 ± 8.32	0.50 : 7.96 ± 7.28	0.50 : 10.33 ± 1.28
NT-M	13.5 : 19.66 ± 1.52	13.5 : 20.83 ± 1.60	13.5 : 18.16 ± 0.76	13.5 : 16.33 ± 1.52
	4.5 : 17.46 ± 1.74	4.5 : 20.50 ± 1.80	4.5 : 17.50 ± 1.32	4.5 : 16 ± 2.64
	1.5 : 16.60 ± 0.34	1.5 : 17.16 ± 1.25	1.5 : 14.33 ± 1.52	1.5 : 13 ± 1.00
	0.50 : 12.50 ± 2.17	0.50 : 13.16 ± 1.25	0.50 : 11.50 ± 1.32	0.50 : 11.33 ± 2.51
GN-M	13.5 : 18.66 ± 1.52	13.5 : 17.33 ± 1.52	13.5 : 15.66 ± 1.52	13.5 : 17.33 ± 2.08
	4.5 : 19.66 ± 1.04	4.5 : 15.46 ± 0.92	4.5 : 12.66 ± 2.75	4.5 : 14.80 ± 1.70
	1.5 : 15.30 ± 1.21	1.5 : 12.13 ± 2.20	1.5 : 11.46 ± 1.28	1.5 : 11.33 ± 2.30
	0.50 : 10.83 ± 1.75	0.50 : 11.66 ± 2.08	0.50 : 7.33 ± 6.42	0.50 : 7 ± 6.24
RJ-C	13.5 : 20.50 ± 1.32	13.5 : 20.16 ± 1.04	13.5 : 17.50 ± 0.50	13.5 : 17.33 ± 0.76
	4.5 : 17 ± 5.26	4.5 : 17.83 ± 1.89	4.5 : 16.83 ± 2.02	4.5 : 18 ± 3.60
	1.5 : 16.16 ± 3.32	1.5 : 15.16 ± 1.04	1.5 : 12.83 ± 2.46	1.5 : 12.50 ± 0.50
	0.50 : 12.16 ± 2.02	0.50 : 7.33 ± 6.42	0.50 : 9.16 ± 0.76	0.50 : 6.5 ± 2.50
MR-C	13.5 : 15.66 ± 2.08	13.5 : 17 ± 3.00	13.5 : 16.16 ± 1.25	13.5 : 16.16 ± 0.76
	4.5 : 13 ± 3.00	4.5 : 14.83 ± 1.04	4.5 : 13.50 ± 1.32	4.5 : 12.33 ± 2.08
	1.5 : 11.33 ± 1.52	1.5 : 11.66 ± 1.52	1.5 : 10.33 ± 3.21	1.5 : 10.16 ± 1.25
	0.50 : 7.33 ± 2.08	0.50 : 7.66 ± 1.52	0.50 : 5 ± 5.00	0.50 : 7.66 ± 6.80
NT-C	13.5 : 18.33 ± 1.52	13.5 : 17.33 ± 2.51	13.5 : 18.33 ± 2.51	13.5 : 17.83 ± 2.02
	4.5 : 17.83 ± 1.25	4.5 : 17.66 ± 3.21	4.5 : 15.83 ± 2.84	4.5 : 15.16 ± 2.56
	1.5 : 12.33 ± 2.08	1.5 : 13.16 ± 3.01	1.5 : 11.83 ± 3.32	1.5 : 10.83 ± 0.76
	0.50 : 10.05 ± 1.80	0.50 : 11 ± 2.00	0.50 : 7.33 ± 6.65	0.50 : 6.83 ± 6.04
GN-C	13.5 : 16.50 ± 2.09	13.5 : 17± 2.00	13.5 : 18.33 ± 3.05	13.5 : 15 ± 2.00
	4.5 : 15 ± 3.04	4.5 : 12.50 ± 2.29	4.5 : 12.66 ± 2.51	4.5 : 12.33 ± 2.08
	1.5 : 12.33 ± 2.08	1.5 : 11.83 ± 1.75	1.5 : 11.33 ± 2.36	1.5 : 8 ± 1.00
	0.50 : 5.66 ± 4.93	0.50 : 10 ± 4.35	0.50 : 8.5 ± 1.32	0.50 : 6.33 ± 1.52
Sm	13.5 : 11.33 ± 1.52	13.5 : 10.33± 3.21	13.5 : 11.33 ± 3.21	13.5 : 13.66 ± 3.51
	4.5 : 13.33 ± 2.08	4.5 : 9.33 ± 2.08	4.5 : 13 ± 4.35	4.5 : 10 ± 1.00
	1.5 : 0 ± 0	1.5 : 0 ± 0	1.5 : 0 ± 0	1.5 : 0 ± 0
	0.50 : 0 ± 0	0.50 : 0 ± 0	0.50 : 0 ± 0	0.50 : 0 ± 0
Az	13.5 : 12.66 ± 1.52	13.5 : 12.33± 2.51	13.5 : 13 ± 3.00	13.5 : 12 ± 2.00
	4.5 : 13 ± 3.00	4.5 :11.33 ± 2.30	4.5 : 12 ± 2.00	4.5 : 12 ± 1.73
	1.5 : 0 ± 0	1.5 : 0 ± 0	1.5 : 0 ± 0	1.5 : 0 ± 0
	0.50 : 0 ± 0	0.50 : 0 ± 0	0.50 : 0 ± 0	0.50 : 0 ± 0
Tc	13.5 : 16.66 ± 2.08	13.5 : 14.33± 5.13	13.5 : 13.33 ± 3.51	13.5 : 13.33 ± 3.05

4.5 : 11.66 ± 2.08 1.5 : 0 ± 0 0.50 : 0 ± 0	4.5 : 13.66 ± 2.51 1.5 : 0 ± 0 0.50 : 0 ± 0	4.5 : 11.66 ± 2.08 1.5 : 0 ± 0 0.50 : 0 ± 0	4.5 : 10 ± 1.00 1.5 : 0 ± 0 0.50 : 0 ± 0



Graph 1 Shows the comparative study of papaya extracts of ethanol, methanol and chloroform of different selected geographical locations against *S. aureus*, *S. pyogens*, *S. typhi* and *P. aeruginosa,* where E-Ethanol, M-Methanol, C-Chloroform and RJ-Udaipur (Rajasthan), MR-Manipur, NT-Nainital, GN- Greater Noida, Sm-Streptomycin, Az-Azithromycin, Tc-Tetracyclin

CONCLUSION

This study shows that the effect of papaya latex collected from different geographical locations has noticeable and marked antibacterial properties against *S. aureus* and *S. pyogens*. The latex specimen collected from Manipur and Nainital (Uttarakhand) has more biologically active compounds compared to the latex from other geographical locations. Ethanol extracts show higher antibacterial activity than methanolic and chloroform extracts. Phytochemical activity shows that latex has a high amount of papain, chymopapain, tannin, flavonoid, phenol, and other compounds that have antimicrobial / antibacterial activity. In recent years the use of Plants and their extracts is considered for the treatment of infectious diseases to control the spread of infectious diseases. Many parts of medicinal plants are proved to have a target antibacterial action of the target site of bacteria. The above experiment of antimicrobial activity in which the latex of papaya from different geographical locations is tested against *S. aureus* and *S. pyogens* by the Disc Diffusion method. The experiment shows that the plant of different geographical locations has a different antimicrobial activity due to its environmental and other growth conditions.

Acknowledgement

I am very grateful to my guide Dr. Shailesh Solanki, who helped me throughout the work by solving all our difficulties that occur during the research work. I am also thankful to our family members and mentors who always enlighten us in every situation. I am very thankful to the Microbiology Institute of Noida International University for providing all facilities during the entire Course Work.

Conflict of interest

I declare that there is no conflict of interest.

Author's contributions

All authors listed have made a substantial, direct, intellectual contribution to the work and approved it for publication.

***Funding**: None*

Data availability

All data sets generated and analyzed during this study are included in the manuscript and in supplementary files.

Ethics statement

This study does not contain any studies with human participants or animals performed by any of the authors. All research works are conducted in suitable scientific manner and do not harm or affect human populations. All work is done in

this paper is self-funded and external funding source of information is available for this paper. All data are checked with special tools and scientific methods twice before being presented in this paper.

LITERATURE CITED

1. Aravind G, Debjit B. 2017. Traditional and medicinal use of *Carica papaya* delivery. BCAB 12, 292–298 (2017).
2. Piddock KJV, Wise R. 1989. Mechanism of resistance to quinolones and clinical perspective. *Journals of Antimicrobial Chemotherapy* 23: 475-483.
3. Egamberdieva D, Teixeira da Silva JA. 2015. Medicinal plant and PGPR: a new frontier for phytochemicals, in plant growth-promoting rhizobacteria (PGPR) and medicinal plants. (Eds) D. Egamberdieva, S. Shrivastava,and A. Varma. Berlin: Springer Verlag: 287-303.
4. Dawson E. 1997. The medicinal properties of the papaya, *Carica papaya* L. *Ethnobotanical Leaflets* 198(2): http://www.siu.edu/~ebl/
5. Handa SS, Khanuja SPS, Longo G, Rakesh DD. 2008. Extraction technologies for medicinal and aromatic plants. Italy: United Nations Industrial Development Organization and the International Centre for Science and High Technology 1(66).
6. Furtado GL, Medeiros AA. 1980. Single-Disc Diffusion Testing (Kirby- Bauer) of susceptibility of *Proteus mirabilis* to chloramphenicol: Significance of the intermediate category. *Jr. Clin. Microbiology* 12: 550-553.
7. Simmonds MSJ. 2003. Flavonoid-insect interactions: recent advances in our knowledge. *Phytochemistry* 64: 21-30.
8. Morsy NM. 2014. Phytochemical analysis of biologically active constituents of medicinal plants. *Main Group Chem.* 13: 7-21.
9. Aruljothi S, Uma C, Sivagurunathan P, Bhuvaneswari M. 2014. Investigation on antibacterial activity of *Carica papaya* leaf extracts against wound infection-causing bacteria. *International Journal of Research Studies in Biosciences* 2(11): 2349-2365.
10. Bastos ML, Lima MR, Conserva LM, Andrade VS, Rocha EM, Lemos RP. 2009. Studies on the antimicrobial activity and brine shrimp toxicity of extracts of *Z. tuberculosa* and their main constituents. *Ann. Clin. Microbiol. Antimicrobiology* 8: 1-16.
11. Nikolaidis I, Favini SS, Dessen A. 2014. Resistance to antibiotics targeted to the bacterial cell wall. *Protein Sci*. 23(3): 243-259.
12. Hafd K. 2020. One-step recovery of latex papain from *Carica papaya* using three phase partitioning and its use as milk-clotting and meat-tenderizing agent. *Int. Jr. Biol. Macromology* 146: 798-810.