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SURVEY OF THE ANTIMICROBIAL PROPERTIES OF SOME MEDICAL FLOWERS AND HERBS

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ABSTRACT

The curious nature of humans has led them to explore various parts of the Earth, the solar system, and even the distant enormous clouds of nebulae that seem to be building and reforming billions of suns and their solar systems.The main aim of the study is Survey Of The Antimicrobial Properties Of Some Medical Flowers And Herbs**.** In this investigation, we focused on four different types of medicinal plants: Terminaliachebula (fruit), Tridaxprocumbens (herb), Euphorbia hirta (rhizomatous herb), and Trichodesmaindicum (weed).The agar well diffusion technique was used to test the in-vitro antibacterial activity of four methanolic extracts of T. chebula, E. hirta, T. indicum, and T. procumbens against S. aureus, E. coli, P. aeruginosa, and B. megaterium isolates, with amoxicillin serving as a positive reference standard.

Keywords: Solar, amoxicillin, Antimicrobial, antibacterial.

1. INTRODUCTION

The curious nature of humans has led them to explore various parts of the Earth, the solar system, and even the distant enormous clouds of nebulae that seem to be building and reforming billions of suns and their solar systems. As long as we've been around, we've had this innate need to keep learning and inventing and imagining better ways to live for everyone on the planet. Exploring these vast natural resources has yielded incredible new botanical, biological, and mineral resources. Plants have played a central role in the development of pharmaceuticals since antiquity, and their compounds continue to be widely used in today's ethnomedicine and traditional medical practises. Plants, animals, and minerals have all played a role in the development of effective treatments for human illness. The roots of medicine go back to the very beginnings of human history. During the past forty years, there has been a dramatic uptick in the study of plants used for medical purposes. Multinational pharmaceutical corporations and academic research institutes are increasingly looking to the plant kingdom's untapped abundance for novel medication and lead chemical candidates. Over the years, scientists have used their knowledge and observations to steadily refine what is now known as Allopathy, the contemporary medical system that is generally acknowledged. Traditional medicine and therapies, however, continue to serve as the foundation for its advancement and will continue to be an essential source for the creation of new treatments.

1.2.1 Collection of plant materials and extraction:

1.2.2 Phytochemical Studies:

Chemical tests were performed on the extracts to see whether they contained any phytoconstituents.

1.2.3 Acute toxicity studies:

Research on the toxicity of a substance in mice, performed according to a standard methodology developed from OECD standards 420 (OECD.2001).

1.2.4 Antioxidant studies:

Humans are equipped with innate antioxidant enzymes to mitigate the damage caused by free radicals. These endogenous enzymes may be downregulated under oxidative stress and excessive free radical production of unknown origin, which may have harmful consequences. Bioactive compounds derived from plants are increasingly becoming recognised as free radical scavengers and health promoters. Hence, the antioxidant activity of the chosen plant extracts was investigated.

2. LITERATURE REVIEW

Kaukab, Rakhshinda&Nisar(2022) Antimicrobial activity of selected medicinal plants was investigated in this research for their efficacy against Gram-negative bacteria like Klebsiella pneumonia and Pseudomonas aeruginosa and Gram-positive bacteria like Staphylococcus aureus and Enterococcus species. The antibacterial susceptibility of these plants was tested using aqueous extracts. The agar well diffusion method was used to assess the antibacterial efficacy of various plant extracts. When tested at 100 uL, the inhibitory zone of the aqueous extract of Zanthoxylumalatum was 35 mm against Enterococcus fecalis and 30 mm against E. fecium. Gerwiaasiatica aqueous extract was the most effective against E. fecalis, with an inhibitory zone of 28 mm. Comparatively, the inhibitory zones of 28 mm and 20 mm for P. aeruginosa and E. fecalis were shown by Juglans regia aqueous extract, demonstrating its superior antibacterial activity. Inhibitory action was not seen for several bacteria, including Staphylococcus aureus, which was resistant to the antimicrobial properties of both G. asiatica and J. regia. This research verified the traditional medical claims made for these plants. Overall, the findings support the use of plants with antibacterial activity against the vast majority of pathogens responsible for food poisoning and spoilage.

Chan, Sze& Fong, Voon& Koo(2022) The purpose of this study is to examine the seeds and pods of Parkia speciosa (Leguminosae; stink bean), the leaves of Citrus microcarpa (Rutaceae; calamansi), and Clerodendrumcalamitosum (Lamiaceae; white butterfly bush) for antibacterial activity. Six solvents of increasing polarity were used in a sequential extraction of the plant components to acquire a broad spectrum of secondary metabolites. There were five different types of human pathogenic bacteria used to test each plant extract. All six medicines tested positive for antibacterial activity, but to varying degrees of bacteriostatic and bactericidal efficacy. In a study using 42 different extracts, 76.2% showed bacteriostatic activity and 47.6% showed bactericidal activity. The hexane and chloroform extracts of N. officinale had the highest bacteriostatic activity against Pseudomonas aeruginosa, with a MIC value of 0.02 mg/mL. The overall activity of the C. microcarpa hexane extract against Bacillus cereus was 56.84 mL/g. All six extracts from the pods were able to inhibit the growth of P. speciosa, but only the hexane and ethanol extracts from the seeds were effective. Because of their potent antibacterial effects (minimum bactericidal concentration: 0.02-2.50 mg/mL), extracts of B. alba and N. officinale merit further isolation and identification of bioactive components.

Nagendran, Thasajini&Krishnapillai, Nahmagal (2019) There are many different types of medicinal plants found in natural environments, and plant extracts have been extensively employed for their bioactive components to treat ailments. As diabetes is the most prevalent metabolic illness, plants known to have anti-diabetic properties were chosen from their natural ecology for this research. Traditional applications for treating diabetes should also be known, hence entomobotanical investigations are crucial. Consequently, the purpose of this research was to examine the ethanobotany and antibacterial activity of chosen plants from their natural ecology. In Jaffna, the mangrove ecology provided the leaves of Gymnemasylvestre, Lumnitzeraracemosa, Acanthus ilicifolius, Avicennia marina, and Excoecariaagallocha, while the littoral forest provided Syzygiumcumini leaves, bark, root, and stem. During 48 hours, plant materials were dried in an oven set at 60 degrees Celsius. In an agar plate experiment, the dried plant powder was tested against E. coli and Aspergillusniger independently at a concentration of 1mg/ml in sterile distilled water. Each nutrient agar and potato dextrose agar plate was inoculated with 1 ml of E. coli ((10 2 cells/ml) and a 0.5cm Aspergillusniger disc, and 1 ml of dried plant powder was added to each plate. To provide as comparison, another set was held without the addition of any leaf powder. During 24 hours, we incubated all bacterial plates at 37°C, whereas fungal plates were left at room temperature (34°C). We measured the diameter of fungal discs produced by Aspergillusniger and the quantity of E. coli colonies to determine the percentage of inhibition. Testing of these plants for their ability to suppress the growth of dangerous diseases revealed an inhibition rate of over 66%.

Singh, Rahul (2018) The purpose of these studies is to determine whether or not fresh extracts of cinnamon zeylanicum bark and Syzygiumaromaticum flower extracts have antibacterial properties. By using the agar well diffusion technique, we were able to examine the antibacterial properties of these extracts against both gram-positive and gram-negative bacteria. Both cinnamon and Syzygium are recognised for their oil, which has powerful anti-pathogen action and is also utilised as an anti-cavity agent in teeth. In some tooth pest, it has been included.

Khan, Amir &Qureshi, RizwanaAleem&Gilani(2011) Here, we look at the antimicrobial effects of crude methanolic extracts of various plant parts from 13 different medicinal plants, all of which were gathered in the Margalla Hills of Islamabad, Pakistan. These plants include Woodfordiafruiticosa, Adhatodavasica, Chenopodiumambrosioides, Viburnum cotinifolium, Euphorbia hirta, Vitexnegundo, Peganumharmala, BroussAspergillusniger, Aspergillusflavus, Aspergillus fumigates, and Rhyzoctoniasolani were the fungal strains tested. For both E. faecalis and E. coccus, the MIC values for the plants Woodfordiafruiticosa, Chenopodiumambrosoides, Viburnum cotinifolium, Euphorbia hirsuta, Vitex negundo, and M. rubicaulis were 1 mg/ml. When tested against E. coli, E. hirta showed the greatest growth inhibition with a MIC value of 1.0 mg/ml. Of the three tested plants, C. grata (86.77%) showed the highest antifungal activity against A. niger, followed by E. hirta (79.72%) and V. cotinifolium (72.39%). In comparison to A. fumigates, A. vasica was more effective in inhibiting its growth (89.50%). V. negundo showed the highest inhibitory efficacy against R. solani (100%). Most effective against both A. flavus (88.93%) and A. fumigates (82.6%), V. cotinifolium showed highest effectiveness against all three.

3. METHODOLOGY

3.1 Plant collection and preparation of sample:

In this investigation, we focused on four different types of medicinal plants: Terminaliachebula (fruit), Tridaxprocumbens (herb), Euphorbia hirta (rhizomatous herb), and Trichodesmaindicum (weed). The plants were chosen after consulting with Ayurveda professionals and reviewing relevant literature. The Saurashtra area of Gujarat, India is where all the plants were gathered, with the help of an Indian herb specialist. A fine powder was made from the newly harvested plant pieces by drying them in the shade away from direct sunshine at room temperature. The soxhlet device was used for the extraction of fine particles.

4. RESULTS

4.1 Antimicrobial assay:

4.1.1 Antimicrobial activity of selected medicinal plants:

All methanolic extracts (100 g/mL) were tested for their in-vitro antibacterial activity against S. aureus, E. coli, P. aeruginosa, and B. megaterium using the agar well diffusion technique. Herbal extract was compared to the effective reference standard, Amoxicillin (100 g/mL), an antibiotic belonging to the extended-spectrum penicillin group..

Table 4.1Methanol extracts from several medicinal plants have antibacterial effects in vitro.

Medicinal plants	Zoneofinhibition(mm)(Mean±S.D.)			
	S.aureus	***B.megaterium***	***E.coli***	***P. aeruginosa***
Terminalia chebula	25.16±0.05	28.50±0.09	12.44±0.04	25.60±0.07
Euphorbiahirta	17.08±0.05	15.66±0.04	22.78±0.04	19.66±0.05
Trichodesma indicum	7.42±0.07	9.41±0.02	11.75±0.02	10.58±0.02
Tridax procumbens	0.00±0.00	1.33±0.04	2.20±0.03	5.58±0.03
Amoxicillin (Standard)	35.03±0.15	35.10±0.17	30.03±0.25	32.17±0.29

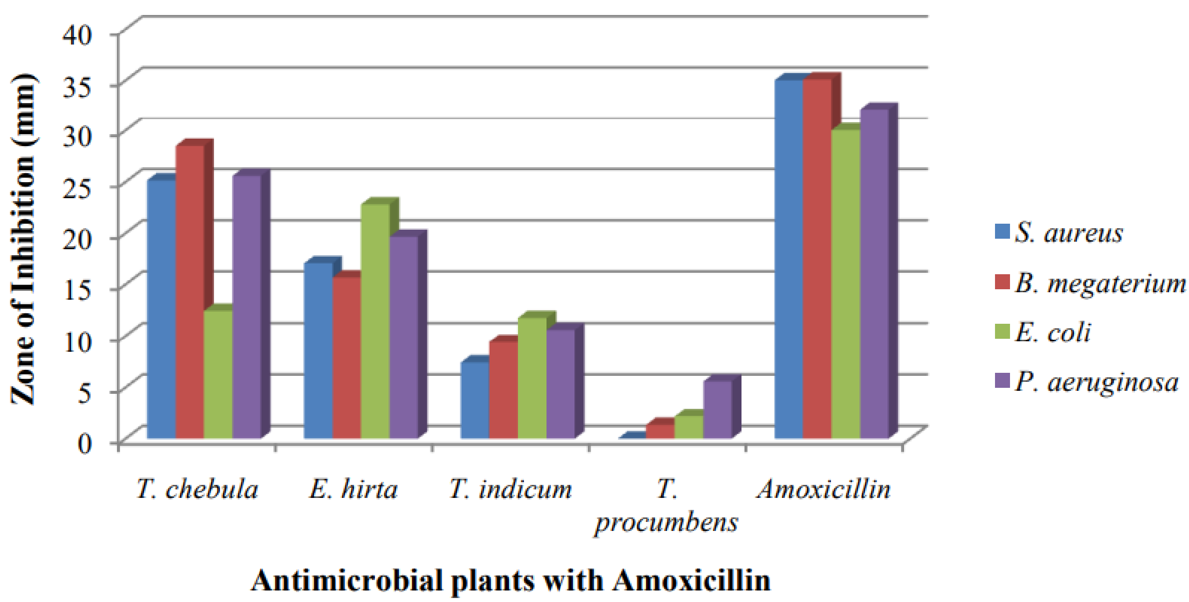

Figure 4.1 Methanolic extracts' antibacterial efficacy compared to that of amoxicillin in vitro

T. chebula extract has been shown to be more effective against S. aureus, B. megaterium, and P. aeruginosa than E. hirta, T. indicum, and T. procumbens extract in an in-vitro comparison of antibacterial activity. Based on the data shown in table 4.1, it seems that the methanolic extract of E. hirta has the highest anti-E. coli activity.

4.2 Antimicrobial activity of different successive extracts of T. chebula:

Each extract was tested for its antibacterial efficacy in vitro against four different isolates using the agar well diffusion technique at a concentration of 100 g/mL. To ensure that every secondary metabolite is extracted in accordance with its polarity nature, extraction was performed using a succession of solvents that progressed from nonpolar to polar. Most of the activity in T. chebula extracts is found in the ethyl acetate fraction, then in the n-butanol, methanol, water, chloroform, and toluene fractions. No significant action was seen in n-hexane.

The findings showed that polar solvents with an intermediate polarity index were where the active principles with antibacterial activities were more often found (ethyl acetate, n-butanol and methanol). Less activity was seen in highly polar solvents and in non-polar solvents, indicating that the active principles were not entirely extracted in those solvents.

Table 4.2 In-vitro antimicrobial activity of successive extract of T. chebula fruit

Extracts	**Zoneofinhibition(mm)(Mean±S.D.)**			
	S.aureus	***B.megaterium***	***E.coli***	***P. aeruginosa***
n-Hexane	1.06±0.06	2.22±0.03	0.00±0.00	0.00±0.00
Toluene	8.83±0.03	10.84±0.04	6.92±0.04	8.14±0.03
Chloroform	10.41±0.03	12.79±0.02	8.92±0.03	9.92±0.03
n-Butanol	26.54±0.05	30.38±0.04	13.04±0.05	26.22±0.03
Ethylacetate	30.13±0.15	35.77±0.21	13.30±0.26	28.03±0.15
Methanol	25.16±0.05	28.50±0.09	12.44±0.04	25.60±0.07
Water	16.59±0.02	18.77±0.03	14.09±0.02	15.07±0.02
Amoxicillin (Standard)	35.03±0.15	35.10±0.17	30.03±0.25	32.17±0.29

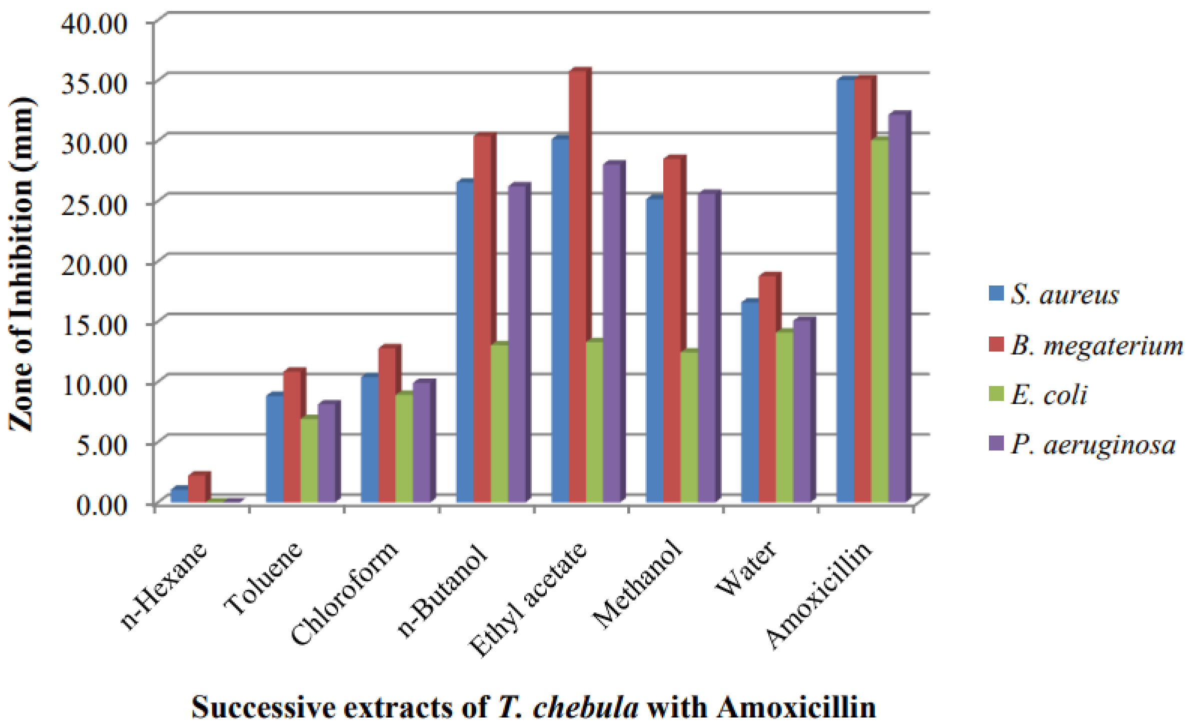

Figure 4.2 Antimicrobial activity of a series of T. chebula extracts in comparison to amoxicillin in vitro on isolated bacteria

As compared to conventional amoxicillin, the greatest antibacterial activity of the ethyl acetate extract occurs at 100 g/mL, which is rather low when compared to the other subsequent extracts. So, in order to find the ideal concentration, further tests were conducted on the extract at 100 g/mL, 500 g/mL, and 1000 g/mL. As compared to the reference medication, activity increases at concentrations of 500 g/mL and above (1000 g/mL). Hence, against S. aureus, B. megaterium, and P. aeruginosa, and comparably effective against E. coli, is a 500 g/mL ethyl acetate extract of T. chebula.

Table 4.3Three distinct concentrations of T. chebula ethyl acetate extract exhibited antibacterial activity in vitro.

Extract/ Standard	**Concentration (µg/ml)**	**Zoneofinhibition(mm)(Mean±S.D.)**			
		S.aureus	***B. megaterium***	***E.coli***	***P. aeruginosa***
Ethyl acetate extract	100	30.13±0.15	35.76±0.21	13.3±0.26	28.03±0.15
	500	37.0±0.2	37.86±0.25	30.03±0.25	31.8±0.20
	1000	38.1±0.17	39.03±0.25	32.06±0.30	34.06±0.21

Amoxicillin (Standard)	100	35.03±0.15	35.1±0.17	30.03±0.25	32.16±0.29

Three distinct concentrations of T. chebula ethyl acetate extract exhibited antibacterial activity in vitro.

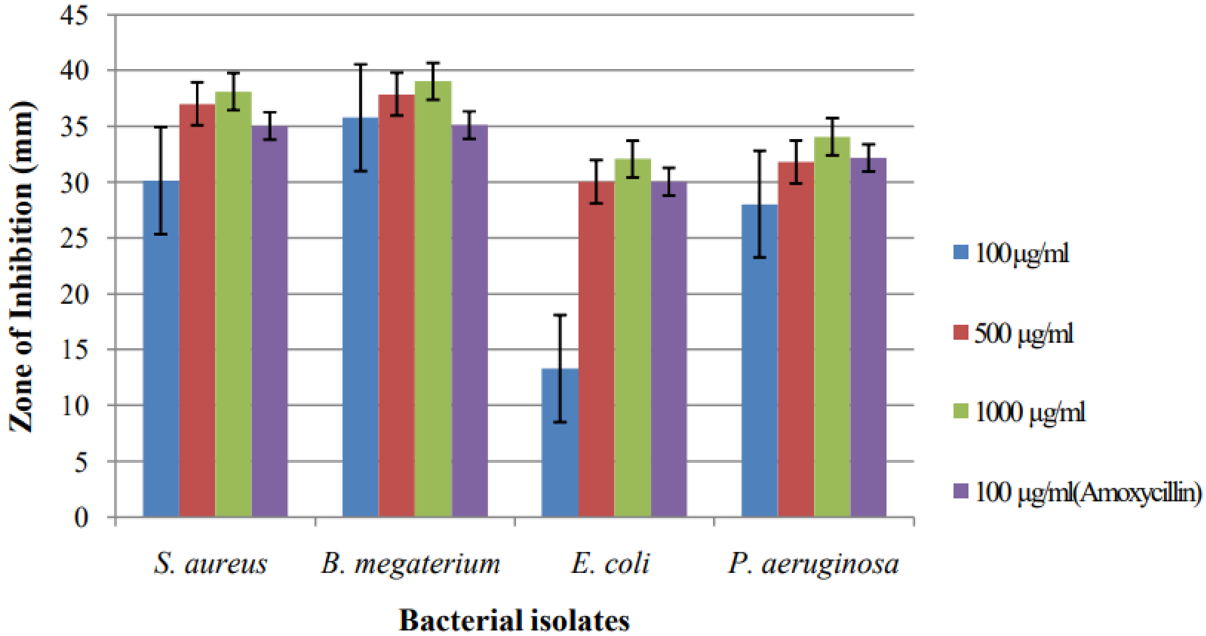

Figure 4.3 Antimicrobial activity of ethyl acetate extract of Terminaliachebula at three concentrations compared to amoxicillin in vitro

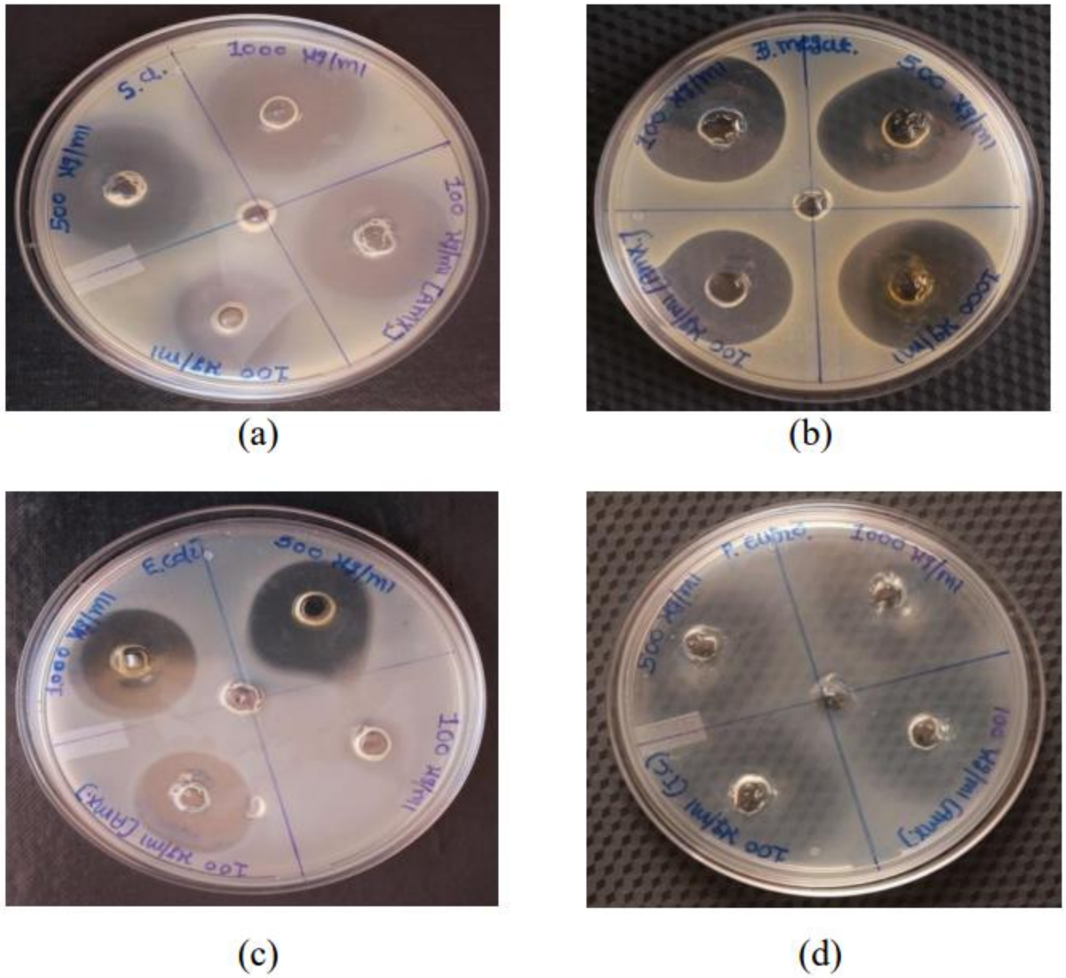

Figure 4.4 .aureus, (b) B. megaterium, (c) E. coli, (d) P. aeruginosa

It has been shown that all T. chebula extracts had the greatest antibacterial activity against B. megaterium, followed by S. aureus, P. aeruginosa, and E. coli (Fig. 4.3). This indicates that, regardless of the solvent used for extraction, B. megaterium is more sensitive to the active components responsible for activity than E. coli. The ethyl acetate extract had the same outcome (Fig. 4.4). The organisms' varying zones of inhibition may be due to the resistance mechanisms they've developed or to the compounds' varying levels of permeability.

4.3 Phytochemical analysis of extract:

When a powerful extract was isolated using antimicrobial assays, it was put through a battery of qualitative testing to look for different types of secondary metabolites. Results for tannins, phenols, and carbohydrates in an ethyl acetate extract of T. chebula fruits (Table 4.4). Evaluation of antibiotic efficacy against bacterial isolates from HIV-infected individuals was performed using chebulic acid, a phenolic acid component obtained from the mature fruits of T. chebula.

Researchers believe that the high phenolic and tannins content of T. chebula is responsible for the plant's antibacterial and antimicrobial activities.

Table 4.4The ethyl acetate extract of T. chebula was subjected to a preliminary phytochemical screening.

Class	Test	Observation	Inference
Alkaloids	Dragendroff'stest	Noprecipitate	–
	Hager'stest	Noprecipitate	–
	Mayer'stest	Noprecipitate	–
	Wagner'sTest	Noprecipitate	–
Glycosides	Borntrager'stest	Noyellowcolor solution	–
	Legal'stest	Nopurplecolor	–
Carbohydrate	Molisch'stest	Purplecolorsolution	+
TanninsandPhenoliccompounds	$FeCl_3$ test	Deepblue-black color	+
	Leadacetatetest	Whiteprecipitate	+
	Brominewatertest	Decolorationof brominewater	+
	Potassiumdichromate ($K_2Cr_2O_7$)test	Redprecipitate	+
	Potassiumpermanganate ($KMnO_4$)test	Decoloration of$KMnO_4$solution	+
Saponins	Frothformationtest	Absenceoffrothing	–
Steroids	Salkowskireaction	Noyellowring formation	–
	Liebermann–burchardreaction	Nogreen color	–
Fixedoils and fats	Alcoholicpotassium hydroxidetest	Absenceofyellow color	–

Flavonoids	Sodiumhydroxide test	Absenceofyellow color	_

5. CONCLUSION

The agar well diffusion technique was used to test the in-vitro antibacterial activity of four methanolic extracts of T. chebula, E. hirta, T. indicum, and T. procumbens against S. aureus, E. coli, P. aeruginosa, and B. megaterium isolates, with amoxicillin serving as a positive reference standard. In comparison to extracts from other plants, T. chebula extract is the most effective against isolates. The exception to this is E. coli, which is more susceptible to extracts from E. hirta. The antibacterial activity in vitro was tested after each consecutive extraction was done using a solvent series progressing from non-polar to polar. T. chebula extracts exhibit the most activity in the ethyl acetate fraction, next in the n-butanol, methanol, water, chloroform, and toluene fractions. No significant action was seen in n-hexane. As compared to the broad-spectrum antibiotic amoxicillin, the T. chebula ethyl acetate extract at a concentration of 500 g/mL is more (against S. aureus, B. megaterium, and P. aeruginosa) or equally (against E. coli) effective.

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