Vol. 5 No. 1 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

PHYTOCHEMICAL AND ANTIBACTERIAL ACTIVITY OF *PISTACIA INTEGERMA* AGAINST MULTI DRUG RESISTANT BACTERIAL PATHOGENS ISOLATED FROM URINARY TRACT INFECTIONS

Khaista Badshah
Department of Health & Biological Sciences, Abasyn University Peshawar, Khyber Pakhtunkhwa, Pakistan. aimalkhan2296@gmail.com

Muhammad Saqib Ishaq
Department of Health & Biological Sciences, Abasyn University Peshawar, Khyber Pakhtunkhwa, Pakistan. saqib.ishaq@abasyn.edu.pk

Rida e Zainab Kayani
Department of Health & Biological Sciences, Abasyn University Peshawar, Khyber Pakhtunkhwa, Pakistan. rida.kayani@abasyn.edu.pk

Muhammad Zahoor
Department of Health & Biological Sciences, Abasyn University Peshawar, Khyber Pakhtunkhwa, Pakistan. zahooalam950@gmail.com

Anmol Rustum
Department of Health & Biological Sciences, Abasyn University Peshawar, Khyber Pakhtunkhwa, Pakistan. anmol33559@gmail.com

Shumaila Jamshed
Department of Health & Biological Sciences, Abasyn University Peshawar, Khyber Pakhtunkhwa, Pakistan. Shumaila.jamshed@abasyn.edu.pk

Syeda Farishta Saba Shah*
Department of Health & Biological Sciences, Abasyn University Peshawar, Khyber Pakhtunkhwa, Pakistan. farishta.shah@hotmail.com

Vol. 5 No. 1 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Badshah et al - 2026

DOI: https://doi.org/10.5281/zenodo.18640445

Author Details

Keywords:

Received on 14 Dec, 2025

Accepted on 29 Jan, 2026

Published on 13 Feb, 2026

Corresponding E-mails & Authors*:

Syeda Farishta Saba Shah

farishta.shah@hotmail.com

Abstract

ABSTRACT

Resistance against drugs has been developed as a result of the overuse and misuse of antimicrobial drugs. *Pistacia integerrima* is an important medicinal plant and a member of family Anacardiaceae and subfamily Anacardioideae. It is a dioecious tree that is native to Asia specifically Pakistan, East Afghanistan and North and West Himalaya to Kumaon. The present study aimed to evaluate the antibacterial activity of the galls of *P. integerrima* against bacteria isolated from urinary tract infections. A total of 36 urine samples were collected from the infected individuals. They were processed according to the standard procedures. Gram staining and different biochemical tests were performed for confirmation of organisms i.e. Catalase, Oxidase, Coagulase, TSI (Triple Sugar Iron), Urease, Indole and Citrate Tests. It was observed that the *E. coli* (33%) was the most predominant specie isolated from UTI patients followed by *Proteus spp*. (22%). *Pseudomonas spp.* accounted for 19% whereas *Bacillus* for 13.8%. The phytochemical analysis of the plant was done and it was ascertained that alkaloids were present in galls-extracts, obtained with ethanol, methanol and water. Flavonoids and tannins were present in ethanolic and aqueous extract whereas absent in methanolic extract. However, saponins were not found in all the tested extracts. Well diffusion method was used for the evaluation of antibacterial activity of the extracts. *Bacillus spp.* showed highest zone of inhibition against

ethanolic, methanolic and aqueous extract i.e. 22 mm, 24 mm and 10 mm respectively. It was noticed that the extract showed best results at 100 µl concentration. Therefore, the extract of *Pistacia integerrima* is recommended to be used in case of Urinary tract infections.

INTRODUCTION

Drug resistant bacterial infections are emerging as a serious health related issue, worldwide, the antibiotic-resistant bacteria are spreading and increasing the morbidity and mortality rates. The development of antibiotic is a time consuming and lengthy process and it depends on the two strategies i.e. isolation of bioactive secondary metabolites from microorganisms and a target-based approach (Cheng *et al.,* 2018, Tacconelli *et al.,* 2018).

New classes of antibiotics need to be made as the old ones are getting resistant. Unfortunately, it will take years and decades to make such number of antibiotics available. As a solution, it can be considered that the resistant antibiotics can be used in combination with some non-antibiotic drugs to overcome resistance. Several drugs that currently donot have any antibacterial indications can be used to reduce the antibiotic MIC, kill bacteria, or modulate the defense through effects on host innate immunity, in particular by altering inflammation and autophagy when used along with the combination of an existing antibiotic (Brown *et al.,* 2015).

Plants are being used for the treatment of different infections since old time (Maciel *et al*., 2002). From time immemorial, many herbs and plants are identified that can be used in relieving from pains in human population worldwide. Herbs are known to be cost effective and safest solution to be used as an alternative to drugs. Almost all the plants have therapeutic plants and their use is famous and well accepted. A large

number of medicinal plants are gifted to us by nature and different medicinal products have been made from them (Lai & Roy, 2004).

The human life in early time was very tough and it was difficult to treat infections because no proper medicines were available. It has been observed that people used plants as medicines and accidently they were used as treatment for a certain disease. Nowadays with the help of the modern sciences, plants and extracts of plants have been discovered that can cure certain diseases. The records written on clay tablets in 3000-5000 Before Common Era (BCE) by Sumerians supported that the humans were able to understand the diseases along with the concept that plants can be used for the maintenance and restoration of good health. It has also been noticed that the selection of using any part of plant can be selective as the utilization of some parts can be more beneficial as compared to others. Therefore, from ancient times those plants that have medicinal values were grown more and remained healthy (Inoue *et al.*, 2019).

The demand and use of the medicinal plants is increasing day by day. Undoubtedly, ecosystem has been provided with essential services by the plants. Humans and other living organisms cannot live without plants. More specifically, the medicinal herbs are acting as an indicator for a healthy ecosystem. It has been shown that the humans were aware of plant properties (more or less) before even the plants were used globally for clothing, shelter, fuel and food. In many countries like Egypt, China, Greece and India these medicinal plants have been transformed. Plants were used as a disinfectant, drug and as an aromatic agent in Persia. The human beings can use medicinal plants as a treatment option (Jamshidi *et al.*, 2018).

Pistacia integerrima is an important medicinal plant and a member of family Anacardiaceae and subfamily Anacardioideae. It is a dioecious tree that is native to Asia

specifically Pakistan, East Afghanistan and North and West Himalaya to Kumaon. The tree grows at a height of 800-1900 m (Pant and Samant, 2010, Jeet *et al.,* 2019). The plant is commonly called Zebrawood or Crab's claw but still the plant has different local names in India (kakring, kakroi, kakkarsinghi, kakar, kakarsinghi) and Pakistan (khanjar, shnai and thoak) (Orwa *et al.,* 2009). The plant has a single stem containing many branches. The plant contains compound leaves. The fruits of the plant are globular having purple to blue color with a diameter of 4-6 mm (Padulosi *et al.,* 2002). The galls are considered as a store house for the secondary metabolites (Chopra *et al,* 1982, Vashit and Anil, 2012).

Pistacia integerrima is used against many diseases which has a very wide range of curative and protective therapeutic efficacy. Now a day's different parts of the plant are still in use in the formulation of herbal medicines. This plant is being used in treating various diseases like gastrointestinal tract (GIT) and respiratory tract disorders (Jeet *et al.,* 2019). It has also been used as analgesic and anti-inflammatory, blood purifier, gastrointestinal disorders such as vomiting and diarrhea, expectorant, cough, asthma, fever and as antidiabetic etc. (Rauf *et al*., 2017, Ahmad *et al.,* 2008 and Uddin *et al.,* 2012).

The galls of the plant have pistacienoic acid, resins, camphene, luteolin, amino acids, tannins, tetracyclic triterpenes, pistancin and dihydromavalic acids (Warrier *et al*., 1995). The galls of the plant have medicinal importance and can be used in the treatment of asthma, cough, bronchitis, dysentery, ulcer, psoriasis, skin diseases, inflammation, pharyngitis, hiccough, fever, ulcer, dyspepsia, leprosy, anorexia, leucorrhoea, and general debility. The stem resins of *P. integerrima* are used for wound

healing, (Hussain *et al.,* 2007) while the stem are also used for fuel, ornamental wood, construction (Hussain *et al.,* 2007) while leaves are used as cattle food (Jan *et al.,* 2009).

MATERIALS AND METHOD

Plant Collection

P. integerrima galls were brought from local market of Mansehra Division. The plants were then identified at laboratory of Botany, Hazara University Mansehra and were subjected to shade drying by the method used by Islam *et al.*, 2015.

Soaking and Extraction

After shade drying, the plant material was chopped and grinded. The sample was extracted using distilled water, methanol and ethanol and left for 7 days (Islam *et al.*, 2015). The residues were separated by filtration. This process was repeated 3 to 4 times and the solvents was recovered through Rotary evaporator at 40-50^{o}C (Ramachandra *et al.,* 2010).

Phytochemical screening

The extract was screened out for the presence of different bioactive constituents i.e. flavonoids, alkaloids, steroids and tannins etc. (Rajurkar & Gaikwad, 2012).

Test for alkaloids

For evaluating the presence of alkaloids, 2-3 ml of filtrate, Mayer's reagent and 1 ml of HCl (diluted) was added in a test tube and shaken. Formation of yellow precipitation showed the presence of alkaloids.

Test for tannins

$FeCl_3$ (5%) solution was added to the extract. The appearance of deep blue color confirmed the presence of tannins.

Test for flavonoids

Dilute sodium hydroxide was added to 1 ml of extract. The solution changed the color to yellow followed by colorless solution after the addition of dilute acid. This confirmed the presence of flavonoids.

Test for saponins

The saponin content was measured by dissolving 0.5 gram of extract in water and boiled. The height of the froth was used for the measurement of saponin in the sample.

Antibacterial activity

Urine Samples were collected from Ayub Medical Complex, Abbotabad using sterile urine bags and bottles. Samples were transported to the Microbiology Laboratory at Abasyn University Peshawar, for culturing and identification of organisms.

Sample Collection

Gram staining and biochemical tests were applied for the confirmation of bacterial species.

Culture Media Used

The isolated samples were cultured on the following media:

- Nutrient Agar media: general purpose media for culturing bacteria
- MHA: for checking the sensitivity pattern of bacterial isolates

Nutrient agar media:

Nutrient Agar is a general purpose used for the culturing of all types of bacteria. It is popular because variety of bacteria can grow on it since it has all the basic nutrients required for the growth of non-fastidious bacteria.

28 grams of the powdered media was added to 1 liter of distilled water. The suspension was then heated to boiling to dissolve the medium completely. The dissolved medium

was autoclaved at 121°C for 15 minutes. After autoclaving, the beaker was taken out and allowed to cool at room temperature. The media was then poured into sterile Petri plates under sterile conditions.

Mueller Hinton Agar Media

It is recommended media for evaluating the antibiotic sensitivity test using Kirby-Bauer disc diffusion method for non-fastidious bacteria (both aerobes and facultative anaerobes).

The media was prepared by dissolving 38 g of media in 1000 ml of distilled water. The media was then stirred and heated for dissolving the components. It was autoclaved for 15 minutes at 121 °C. After autoclaving, the media was left to cool. It was then poured in petri plates. The sample was inoculated and plates were incubated at 37°C for 24 hrs.

Sample Processing

Streak plate method was used for the inoculation of samples on the media. All plates were incubated for 24 hours at 37℃.

The bacteria were then identified using standard gram staining and biochemical test procedures.

Identification of MDR Isolates

Disc diffusion method was used for the identification of antibacterial activity. A total of 10 different antibiotics were used i.e. CIP, CHL, CRO, CFM, AML, GEN, CAZ, DO, AMP and MEM.

Antibacterial Activity of Extract

Well diffusion method of (Ishaq *et al.*, 2014) was followed with some modifications for the antibacterial activity of extracts. Pre-autoclaved MHA plates were

inoculated with diluted bacterial culture, using sterile cotton swabs to achieve uniform lawn of growth and sterile borer were used to bore wells in the agar.

Extracts of galls of *Pistacia integerrima* in three different concentrations i.e. 100 µl, 75 µl and 25 µl were used for the evaluation of antibacterial activity.

RESULTS

Phytochemical Analyses

From phytochemical analyses, it was ascertained that alkaloids were present in galls-extracts, obtained with ethanol, methanol and water. Flavonoids and tannins were present in ethanolic and aqueous extract whereas absent in methanolic extract. However, saponins were not found in all the tested extracts.

Table 1: Phytochemical Analysis of Extracts of *P. integerrima* galls with different Solvents

Constituents	Ethanol	Methanol	H_2O
Alkaloids	+	+	+
Flavonoids	+	-	+
Saponins	-	-	-
Tannins	+	-	+

Key: + = Detected, - = Not-Detected

Identification of bacteria:

A total of 36 urine samples were collected from the infected individuals. Among them 19 were collected from female patients and 17 were collected from male patients having urinary tract infections (Figure 1).

Vol. 5 No. 1 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

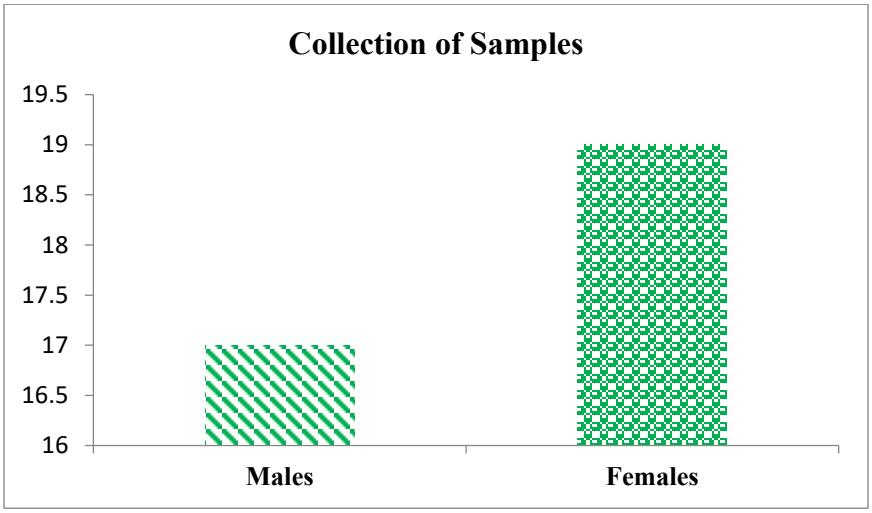

Figure 1 Gender wise Collection of Urine Sample

Identified Organisms	Gram's Reaction	Citrate Test	Indole Test	Oxidase Test	Coagulase Test	Urease Test	Catalase Test	TSI test
E. coli	-	-	+	-	-	-	+	A/A
Proteus spp.	-	+	-	-	+	+	+	K, H_2S
S. aureus	+	-	-	+	+	-	+	K, H_2S
Pseudomonas spp.	-	+	-	+	-	-	+	NC
Bacillus spp.	+	+	-	+	-	-	+	A/K

A total of 5 bacterial species were identified using standard procedures of gram staining and biochemical tests. The samples were processed according to the standard procedures i.e. gram staining and biochemical tests. The results of the gram staining and biochemical tests are shown in the table 2.

Table 2: Identification of bacterial species

Key: +: Positive, : Negative, ±: Variable, NC: No change, A: Acid production, K: alkaline reaction; K/AG: Red/yellow with gas production, K/A: Red/yellow, H_2S: Sulfur reduction,

It was observed that the *E. coli* (33%) was the most predominant specie isolated from UTI patients followed by *Proteus spp*. (22%). *Pseudomonas spp.* accounted for 19% whereas *Bacillus* for 13.8% (Figure 2).

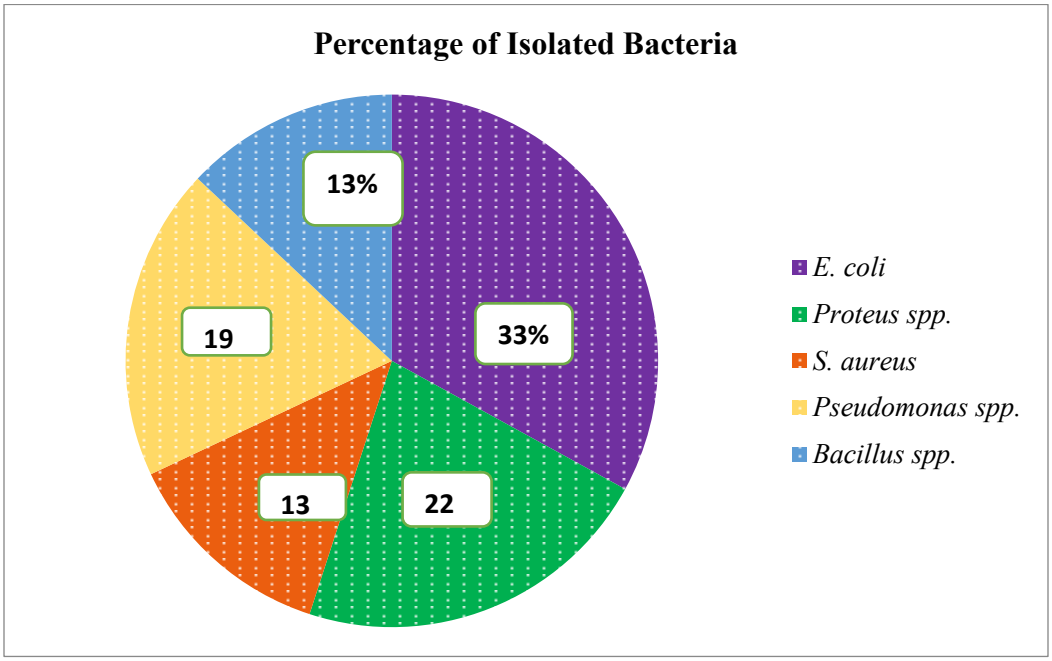

Figure 2 Percentage Wise Distribution of Bacteria Isolated from UTI

Antibacterial activity

For the identification of MDR bacteria species, a total of 10 antibiotics were used i.e. CHL, MEM, AMP, DO, CAZ, GEN, AML, CFM, CRO, CIP. It was noticed that the all the bacterial species isolated showed Multi Drug Resistant pattern. The zones of inhibition of antibiotics against bacterial isolates are shown in table 3.

Table 3: Identification of multi drug Resistant bacterial isolates

Bacterial species	CIP	CHL	CRO	CFM	AML	GEN	CAZ	DO	AMP	MEM
E. coli	R	17	16	R	R	20	14	11	R	16
Proteus spp.	25	18	15	20	R	17	R	13	13	16
S. aureus	20	19	18	19	R	19	R	22	12	22
Pseudomonas spp.	25	17	22	R	18	21	23	R	19	20
Bacillus spp.	18	21	17	R	R	R	14	11	R	17

Antibacterial sensitivity of the bacterial species

The extracts were screened for the antibacterial activity using well diffusion method. A total of 05 bacterial isolates were used for evaluating the antibacterial activity i.e. E. coli, Pseudomonas spp., Proteus spp., S. aureus, and Bacillus spp.

S.NO	Species name	100 µl concentration	75 µl concentration	25 µl concentration
1	*Bacillus spp.*	24 mm±0.5	19 mm±0.5	14 mm±0.5
2	*E. coli*	18 mm±0.5	13 mm±0.5	10 mm±0.5
3	*Pseudomonas spp.*	16 mm±0.5	12 mm±0.5	08 mm±0.5
4	*S. aureus*	17 mm±0.5	12 mm±0.5	09 mm±0.5
5	*Proteus spp.*	14 mm±0.5	09 mm±0.5	06 mm±0.5

Antibacterial activity of ethanolic extract:

It has been revealed that the highest zone of inhibition was produced against Bacillus spp. (22 mm) followed by S. aureus (19 mm) and Pseudomonas spp. (17 mm)

when the ethanolic extract was used at 100 µl concentration. The results of 75 µl and 25 µl concentration are shown in the Table 4.

Table 4: Antibacterial activity of Ethanolic extract of galls against different bacterial species

S.NO	Species name	100 µl concentration	75 µl concentration	25 µl concentration
1	*Bacillus spp.*	10 mm±0.5	08 mm±0.5	04 mm±0.5
2	*E. coli*	Nil	Nil	Nil
3	*Pseudomonas spp.*	Nil	Nil	Nil
4	*S. aureus*	06 mm±0.5	04 mm±0.5	02 mm±0.5
5	*Proteus spp.*	Nil	Nil	Nil

Antibacterial activity of methanolic extract:

It has been revealed that the highest zone of inhibition was produced against *Bacillus spp.* (24 mm) followed by *E. coli* (18 mm) and *S. aurues* (17 mm) when the methanolic extract was used at 100 µl concentration. The results of 75 µl and 25 µl concentration are shown in the table 5.

Table 5: Antibacterial activity of methanolic extract of gall against different bacterial species

Antibacterial activity of aqueous extract:

At 100 µl concentration of aqueous extract the highest zone of inhibition was noticed against *Bacillus spp.* (10 mm) followed by *S.aureus* (6 mm) whereas no zone was

observed against other bacterial species. Similarly, the results of using 75 µl and 25 µl aqueous extract are given in the Table 6.

S. No	Species Name	100 µl concentration	75 µl concentration	25 µl concentration
1	*Bacillus spp.*	22 mm±0.5	17 mm±0.5	12 mm±0.5
2	*E. coli*	15 mm±0.5	11 mm±0.5	08 mm±0.5
3	*Pseudomonas spp.*	17 mm±0.5	13 mm±0.5	10 mm±0.5
4	*S. aureus*	19 mm±0.5	15 mm±0.5	12 mm±0.5
5	*Proteus spp.*	12 mm±0.5	08 mm±0.5	05 mm±0.5

Table 6: Antibacterial activity of aqueous extract of gall against different bacterial species

DISCUSSION

There is an increasing resistance to antibiotics by bacteria, therefore there is a need to develop alternative antimicrobial compounds for treating infections. So, new compounds are in search that can be combined with antibiotics to overcome the resistance in bacteria. There are variety of medicinal plants present in the ecosystem. These medicinal plants can be used for the treatment of various infections as they contain the biologically active compounds or phytochemicals that shows antimicrobial properties (Sibanda & Okoh, 2007).

The present study aimed to evaluate the antibacterial activity of the galls of *P. integerrima* against bacteria isolated from urinary tract infections. The extract was

prepared in three different solvents i.e. ethanol, methanol and distilled water. It was observed that the *E. coli* (33%) was the most predominant specie isolated from UTI patients followed by *Proteus spp*. (22%). *Pseudomonas spp.* accounted for 19% whereas *Bacillus* for 13.8%.

The galls extract of the plant is common practice in folk medicine which revealed the presence of alkaloids, terpenoids, flavonoids and tannins. The bark showed the presence of terpenoids, flavonoids while the leaves and roots extracts showed the presence of terpenoids and tannins (Uddin *et al*., 2011). *P. Integerrima* Galls Stewart was used for the investigation of phytochemicals and antimicrobial activities of ethyl acetate, methanol, chloroform and *n-hexane* (Uddin *et al*., 2012). The bark of the plant was tested for the presence of phytochemicals and it was noticed that tannins, alkaloids, flavonoids etc. were present (Ismail *et al*., 2011). In the current study, it was ascertained that alkaloids were present in galls-extracts, obtained with ethanol, methanol and water. Flavonoids and tannins were present in ethanolic and aqueous extract whereas absent in methanolic extract. However, saponins were not found in all the tested extracts.

The antibacterial activity of *P. integerrima* was noticed against six clinical isolated that were identified as multidrug resistant bacteria. The activity was performed on *Esch. coli, K. pneumoniae, P. aeruginosa* and *S. aureus* pathogenic bacteria. Significant activity was observed by the galls extract. Among the solvents, water and chloroform extract showed moderate activity while maximum activity was noticed by the methanol and ethanol extract (Bharathirajan, 2015). The antibacterial efficacy and phytochemical observation of *P. integerrima* and some other plants against seven different microorganisms such as *Esch. coli, S. typhi, K. pneumoniae, P. vulgaris, Pseudomonas, B.*

subtillis and *Staph. aureus* by using disc diffusion method was done (Selvi, 2016). In the current research study, MDR bacterial species were identified using several antibiotics i.e. CIP, CHL, CRO, CFM, AML, GEN, CAZ, DO, AMP and MEM. Additionally, the growth of test organisms was markedly inhibited by ethanol extract of *P. integerrima* which was exactly similar to the present research in which the growth was inhibited by ethanol extract.

Ramachandra (2010) used the ethanol and aqueous extracts of galls of *P. integerrima* for anti-bacterial activity. All the strains of Bacteria showed susceptibility towards both the extracts. The ethanol extract showed better activity profile as compared to the aqueous extract. Uddin and Rauf (2012) evaluated the antimicrobial phytochemical properties of ethyl acetate, methanol, chloroform and n-hexane fraction of *P. integerrima* in which the extract in ethyl acetate, chloroform and methanol showed potent activity against Gram positive and Gram negative bacterial strains. In the present research work, when ethanolic extract was used, highest zone of inhibition was produced against *Bacillus spp.* (22 mm) followed by *S. aureus* (19 mm) and *Pseudomonas spp.* (17 mm) when the ethanolic extract was used at 100 µl concentration. Similarly, for methanolic extract, highest zone of inhibition was produced against *Bacillus spp.* (24 mm) followed by *E. coli* (18 mm) and *S.aurues* (17 mm) when the methanolic extract was used at 100 µl concentration. Furthermore, using aqueous extract, the highest zone of inhibition was noticed against *Bacillus spp.* (10 mm) followed by *S.aureus* (6 mm) whereas no zone was observed against other bacterial species.

CONCLUSION

From the present study, it is concluded that *E. coli* (33%) was the most predominant specie isolated from UTI patients followed by *Proteus spp*. (22%). *Pseudomonas spp.* accounted for 19% whereas *Bacillus* for 13.8%. From phytochemical analysis, it was noticed that alkaloids were present in galls-extracts, obtained with ethanol, methanol and water. Flavonoids and tannins were present in ethanolic and aqueous extract whereas absent in methanolic extract. However, saponins were not found in all the tested extracts. *Bacillus spp.* showed highest zone of inhibition against ethanolic, methanolic and aqueous extract i.e. 22 mm, 24 mm and 10 mm respectively. It was noticed that the extract showed best results at 100 µl concentration.

REFERENCES

Ahmad, I., Mehmood, Z., & Mohammad, F. (1998). Screening of some Indian medicinal plants for their antimicrobial properties. Journal of Ethnopharmacology 62, 183–193.

Ahmad, N. S., Farman, M., Najmi, M. H., Mian, K. B., & Hasan, A. (2008). Pharmacological basis for use of Pistacia integerrima leaves in hyperuricemia and gout. *Journal of ethnopharmacology*, *117*(3), 478-482.

Ahmad, R., Pieters, L., & Riaz, M. (2013). Antimicrobial and antioxidant activity of crude extracts of two medicinal plants** Pistacia integerrima** and** Debregeasia salicifolia. *International journal of pharmaceutical sciences: review and research*, *18*(1), 13-17.

Ahmad, S., Ali, M., Ansari, S. H., Ahmed F. (2010). Phytoconstituents from the galls of Pistacia integerrima Stewart. J Saudi ChemSoc 2010, 14:409-412.

Bano, K., Khan, J., Begum, R. H., Munir, S., Akbar, N., Ansari, J. A., & Anees, M. (2012). Patterns of antibiotic sensitivity of bacterial pathogens among urinary tract infections (UTI) patients in a Pakistani population. Afr J Microbiol Res, 6(2), 414-20.

Bharathirajan, R., & Prakash, M. (2015). Analysis of IR, NMR and invitro antibacterial Potency of Pistacia integerrima against 6 Clinically Isolated Multidrug Resistant Bacteria. *Int. J. Curr. Microbiol. App. Sci*, *4*(6), 1174-1190.

Bibi, Y., Abdul, Q., and Zia, M. (2015). An Overview of Pistacia integerrima a medicinal plant species: Ethnobotany, biological activities and phytochemistry. Pakistan journal of pharmaceutical science :1008 1015.

Bibi, Y., Nisa, S., Chaudhary, M. F., and Zia, M. (2011). Antibacterial activity of some selected medicinal plants of Pakistan. BMC Comp. Alt. Med., 11: 52.

Brown, D. (2015). Antibiotic resistance breakers: can repurposed drugs fill the antibiotic discovery?. *Nature reviews Drug discovery*, *14*(12), 821-832.

Cheng, Y. S., Sun, W., Xu, M., Shen, M., Khraiwesh, M., Sciotti, R. J., & Zheng, W. (2018). Repurposing screen identifies unconventional drugs with activity against multidrug resistant Acinetobacter baumannii. Frontiers in cellular and infection microbiology, 8.

Chopra, R. N., Chopra, I. C., Handa, K. L., and Kapoor, L. D. (1982).Indigenous Drugs of India (2nd Eds.)Academic Publishers, India.Pp.377-79.

Habiba, U., Ahmad, M., Shinwari, S., Sultana, S., Shinwari, Z. K., & Zafar, M. (2016). Antibacterial and antifungal potential of Himalayan medicinal plants for treating wound infections. Pak J Bot, 48, 371-5.

Hussain, F., Shah, S. M., and Sher, H. (2007).Traditionnal resource evaluation of some plants of mastuj, district chitral, Pakistan. Pak. J. Bot., 39: 339-354.

Inoue, M., Hayashi, S., & Craker, L. E. (2019). Role of medicinal and aromatic plants: Past, present, and future. *Pharmacognosy-Medicinal Plants*.

Ishaq, M. S., Hussain, M. M., SiddiqueAfridi, M., Ali, G., Khattak, M., & Ahmad, S. (2014). In vitro phytochemical, antibacterial, and antifungal activities of leaf, stem, and root extracts of Adiantumcapillusveneris. The Scientific World Journal, 2014.

Islam, M. S., Ali, M. A., & Sarker, M. N. I. (2015). Efficacy of medicinal plants against seed borne fungi of wheat seeds. *International Journal of Natural and Social Sciences*, *2*(1), 48-52.

Jamshidi-Kia, F., Lorigooini, Z., & Amini-Khoei, H. (2018). Medicinal plants: Past history and future perspective. *Journal of herbmed pharmacology*, *7*(1).

Jan, G., Khan, M. A., and Gul, F. (2009). Ethno medicinal Plants Used against Jaundice in DirKohistan Valleys (NWFP), Pakistan Ethnobotanical Leaflets, 13: 1029-1041.

Jeet, K., & Baldi, A. (2019). A Comprehensive Review on Pistacia integerrima. Current Traditional Medicine, 5(2), 98-113.

Joshi, U.P., and Mishra, S. H. (2009).In vitro anti-oxidant activity of galls of pistaciaintegerrima. Pharmacology online, 2: 763-768.

Khalid, A., Waseem, A., Saadullah, M., Rehman, U.U., Khiljee, S., Sethi, A., Hassham, M., Asad, B. H., Rasool, F., Khurram, M., Waqas., and Murtaza, G.(2011). Antibacterial activity analysis of extracts of various plants against gram -positive and -negative bacteria.AJPP.5(7), 887-893. 7B5815229222

Khatoon, A., Rehman, S., Hiraga, S., Makino, T., and Komatsu, S. (2012).Organ-specific proteomics analysis for identification of response mechanism in soybean

seedlings under flooding stress. Journal of Proteomics, 75(18), 5706–5723. doi:10.1016/j.jprot.2012.07.031

Lai, P., and Roy, J. (2004).Antimicrobial and Chemo preventive Properties of Herbs and Spices. Current Medicinal Chemistry, 11(11), 1451–1460. doi:10.2174/0929867043365107.

Maciel, m., pinto, a., veiga, j., grynberg, n., and echevarria, a. (2002) medicinal plants: the need for multidisciplinary scientific studies. Quim nova. 25(3): 429-38

Nair, R., Kalariya, T., and Chanda, S. (2005). "Antibacterial activity of some selected Indian medicinal flora", Turkish Journal of Biology, 29, 41-47.

Orwa, C., Mutua, A., Kindt, R., Jamnadass, R., and Simons, A. (2009).Agroforestreedatabase:a tree reference and selection guide version 4.0 (http://www.world agroforestry.org/af/treedb/).

Padulosi, S., Hodgkin, T., Williams, J., and Haq, N. (2002).Managing Plant Genetic Diversity. Wallingford: IPGRI/CABI Publishing, 323- 338.

Pant, S., and Samant, S. S. (2010). Ethnobotanical observations in the mornaula reserve forest of Kumaon, west Himalaya, India. Ethnobotanical Leaflets, 14: 193.

Rahman, S., Ismail, M., Muhammad, N., Ali, F., Chishti, K. A., & Imran, M. (2011). Evaluation of the stem bark of Pistacia integerrima Stew ex Brandis for its antimicrobial and phytotoxic activities. African Journal of Pharmacy and Pharmacology, 5(8), 1170-1174.

Rajurkar, N. S., & Gaikwad, K. (2012). Evaluation of phytochemicals, antioxidant activity and elemental content of Adiantum capillus veneris leaves. *Journal of chemical and pharmaceutical research*, *4*(1), 365-374.

Ramachandra, Y. L., Ravi., S. B .E., Sujan G. S., and Sundar, R. S.(2010). In-vitro antimicrobial activity of Pistaciaintegerrima leaf gall extracts. Pharmacophore.1:149-154.

Rauf, A., Abu-Izneid, T., Maalik, A., Bawazeer, S., Khan, A., Ben Hadda, T & Uddin, G. (2017). Gastrointestinal motility and acute toxicity of pistagremic acid isolated from the galls of Pistacia integerrima. Medicinal Chemistry, 13(3), 292-294.

Rauf, A., Uddin, G., Latif, A, and Muhammad N. (2014).Pistagremic Acid, a Novel Antimicrobial and Antioxidant Isolated from *Pistacia integerrima*.Chem Nat Compd.50: 97. doi.org/10.1007/s10600-014-0875-2

Selvi, S., Devi, P. U., Chinnaswamy, P., Giji, T. M., & Sharmila, S. P. (2006). Antibacterial efficacy and phytochemical observation of some Indian medicinal plants. Ancient science of life, 26(3), 16.

Sethi, M. H. H. B. A., Rasool, F., & Khurram, M. (2011). Antibacterial activity analysis of extracts of various plants against gram-positive and-negative bacteria. African Journal of Pharmacy and Pharmacology, 5(7), 887-893

Shuaib, M., Ali, K., Zeb, U., Hussain, F., Zeb, M. A., Hussain, S., & Hussain, F. (2017). Evaluation of Pistacia integrrima; an important plant. *Inter J of Biosciences*, *11*(5), 412-42.

Sibanda, T., & Okoh, A. I. (2007). The challenges of overcoming antibiotic resistance: Plant extracts as potential sources of antimicrobial and resistance modifying agents. *African Journal of Biotechnology*, *6*(25).

Srinivasan, D., Sangeetha, N., Suresh, T., and Lakshmana, P. P. (2001). "Antimicrobial activity of certain Indian medicinal plants used in folkloric medicine", Journal of Ethnopharmacology, 74, 217-220.

Tacconelli, E., Carrara, E., Savoldi, A., Harbarth, S., Mendelson, M., Monnet, D. L., & Ouellette, M. (2018). Discovery, research, and development of new antibiotics: the WHO priority list of antibiotic-resistant bacteria and tuberculosis. *The Lancet Infectious Diseases*, *18*(3), 318-327.

Uddin, G. A., Rauf, M., Arfan.,Waliullah, I., Khan, M. Ali., Taimur, I. Ur-Rehman., and Samiullah. (2012). Pistagremic acid a new leishmanicidaltriterpene isolated from Pistacia integerrima Stewart. Journal of Enzyme Inhibition and Medicinal Chemistry Enzyme, 27(5): 646-8.

Uddin, G., & Rauf, A. (2012). In vitro antimicrobial profile of Pistacia integerrima galls Stewart. *Middle-East Journal of Medicinal Plants Research*, *1*(2), 36-40.

Uddin, G., Rauf, A., Rehman, T. U., & Qaisar, M. (2011). Phytochemical screening of Pistacia chinensis var. integerrima. *Middle-East J Sci Res*, *7*(5), 707-711.

Uddin, G., Rauf, A., Siddiqui, B. S., & Khan, H. (2013). The biological screening of extracts/fractions of various parts of Pistacia integerrima stewart against pathogenic fungi. *Transl Med*, *4*(120), 2161-1025.

Vashist, H., and Anil, J. (2012).Antimicrobial Activities of Medicinal Plants.L. R. Institute of Pharmacy, Rajgarh Road, Solan, Himachal Pradesh, India.Ijrpbsonline.3 (1). ISSN: 2229-3701.

Warrier, P. K., Nambiar, V. P. K., and Ramankutt.(1995). Indian Medicinal Plants. Vol. 4, Universities Press, Hyderabad, 304-307.

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387
Print ISSN 3007-2379

Fig 1: Galls of *Pistacia integerma*

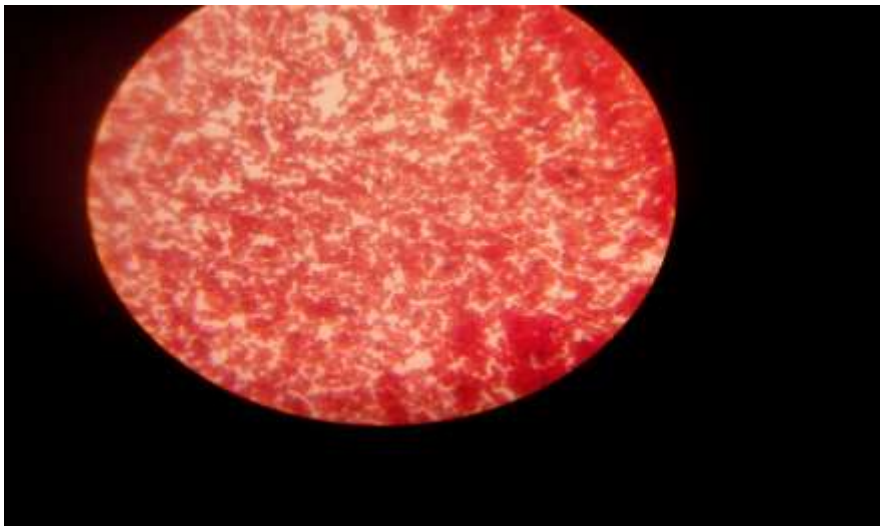

Fig 2. Results of Gram Staining

Vol. 5 No. 1 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

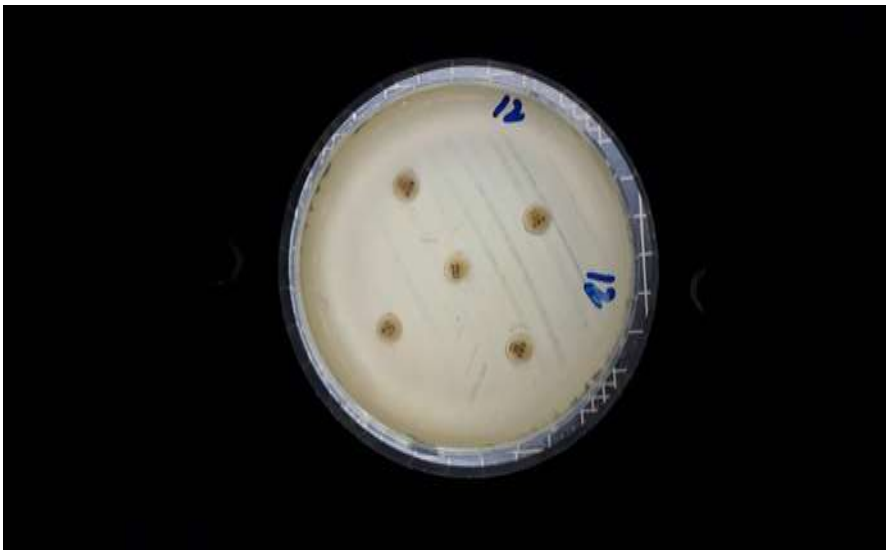

Fig 3. Identification of Multi Drug Resistant Bacteria