BIOPROSPECTING NARMULI

ANTIMICROBIAL ACTIVITY AGAINST BACTERIAL ISOLATES FROM

TOMATO AND POTATO

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"BIOPROSPECTING NARMULI: ANTIMICROBIAL ACTIVITY AGAINST BACTERIAL ISOLATES FROM TOMATO AND POTATO"

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Abstract

Medicinal plants are important sources of bioactive compounds with significant therapeutic potential and fewer side effects than many synthetic drugs. *Cuscuta reflexa* Roxb. (Amarbel), a medicinal parasitic plant, is known for its antimicrobial, antioxidant, and anti-inflammatory properties. The present study, entitled **"Bioprospecting of *Cuscuta reflexa*: Antimicrobial Activity Against Bacterial Isolates from Tomato and Potato,"** aimed to evaluate its phytochemical composition and antibacterial activity against bacterial isolates obtained from infected tomato (*Solanum lycopersicum*) and potato (*Solanum tuberosum*) samples collected from Dehradun, Uttarakhand.

Bacterial isolates were obtained using serial dilution and spread plate techniques and identified through Gram staining and various biochemical tests. The isolates were predominantly Gram-negative and showed diverse biochemical characteristics.

Qualitative phytochemical screening of *Cuscuta reflexa* revealed the presence of alkaloids, flavonoids, tannins, terpenoids, steroids, and phenolic compounds, while saponins were absent. The antimicrobial activity of the ethanolic extract was evaluated using Minimum Inhibitory Concentration (MIC) and agar diffusion methods. The extract exhibited clear zones of inhibition against the bacterial isolates, indicating effective antibacterial activity.

Furthermore, the ethanolic extract was formulated into herbal capsules using lactose, microcrystalline cellulose, starch, and Aloe vera gel as excipients. The formulated capsules showed acceptable stability and uniformity. Overall, the study demonstrated that *Cuscuta reflexa* possesses promising antimicrobial properties and may serve as a natural alternative to synthetic antimicrobial agents for agricultural and pharmaceutical applications.

Key words - Antimicrobial, medicinal plant, herbal, bacterial isolation, bio prospecting, ethanolic extract, Cuscuta reflex.

1. Introduction

Medicinal plants have been used since ancient times as an important source of therapeutic agents and continue to play a significant role in healthcare systems worldwide. Ayurveda, one of the oldest traditional systems of medicine, relies heavily on plant-based remedies due to their effectiveness and comparatively fewer side effects than synthetic drugs.[1]

The medicinal value of plants is mainly attributed to the presence of bioactive compounds such as alkaloids, flavonoids, glycosides, tannins, terpenoids, saponins, and phenolic compounds. These phytochemicals exhibit diverse biological activities, including antimicrobial, antioxidant, anti-inflammatory, and anticancer properties.[2][3]

Plants produce a wide range of secondary metabolites that serve as defense mechanisms against pathogens, insects, and environmental stress. These compounds have gained considerable attention because of their potential applications in pharmaceuticals, food preservation, agriculture, and biotechnology (Savoia, 2012). The systematic exploration of biological resources for identifying such valuable compounds is known as bioprospecting. This approach has become increasingly important in the discovery of novel bioactive molecules and the development of sustainable alternatives to synthetic chemicals.[4]

In recent years, the growing problem of antimicrobial resistance and the environmental concerns associated with excessive pesticide use have increased the demand for natural antimicrobial agents. Plant-derived compounds offer a promising alternative because they are biodegradable, eco-friendly, and often possess multiple mechanisms of action that reduce the risk of resistance development.[5] Therefore, medicinal plants are being extensively investigated for their antimicrobial potential against human and plant pathogens.

Agricultural productivity is significantly affected by bacterial diseases that attack economically important crops such as tomato (*Solanum lycopersicum*) and potato (*Solanum tuberosum*). Bacterial pathogens including *Pseudomonas*, *Xanthomonas*, and *Pectobacterium* species cause severe diseases that lead to considerable yield and quality losses. Conventional management practices rely largely on chemical pesticides and antibiotics, which may result in environmental pollution and the emergence of resistant microbial strains.[6][7] Consequently, there is an urgent need to identify safer and sustainable alternatives for plant disease management.

Among medicinal plants, *Cuscuta reflexa* Roxb., commonly known as Amarbel or Dodder, has attracted attention due to its wide range of therapeutic properties. It is a parasitic climbing plant belonging to the family Convolvulaceae and is commonly distributed throughout India. Traditional medicinal systems have utilized *C. reflexa* for the treatment of fever, inflammation, skin disorders, liver ailments, and hair-related problems. Phytochemical studies have revealed the presence of important bioactive constituents such as alkaloids, flavonoids, glycosides, tannins, and phenolic compounds, which contribute to its antimicrobial, antioxidant, anti-inflammatory, and anticancer activities. [8]

Despite its recognized medicinal importance, the antimicrobial potential of *Cuscuta reflexa* against bacterial pathogens associated with tomato and potato crops has not been extensively investigated. Exploring its bioactive properties may provide valuable insights into the development of natural plant protection strategies. Plant-derived antimicrobial compounds can inhibit microbial growth through multiple mechanisms, including disruption of cell membranes, inhibition of enzyme activity, and interference with genetic replication, thereby reducing the likelihood of resistance development.[9]

1.1 Cuscuta reflexa

Cuscuta is a group of 100- 170 species of yellow, orange, red or rarely green parasitic plants. Cuscuta belongs to the Cuscutaceae family and now on the basis of Angiosperm phylogeny group it is accepted as belonging to morning glory family, Convolvulaceae.[10]

Cuscuta is found at the temperate and tropical regions of the world with huge species diversity in tropical and subtropical regions. Cuscuta reflexa is commonly called as dodder plant, and also known as devil's hair, witch's hair, love vine, amarbel or akashabela etc. Cuscuta reflexa is a parasitic weed plant and also an extensive climber. Cuscuta grows as homoparasite, it has very low-level chlorophyll and photosynthesis activity; completely depends over the host plant for its survival. Dodder plant sucks nutrient sap from the host plant via vascular tissue of the host plant and grows itself. This plant has no roots in the ground and it grows over the host body without touching the ground surface in its complete life span.[11]

Dodder plant has the ability not only to recognize its host plant but also to move towards its prey with significant precision and efficiency. Dodder plant can also choose an appropriate host between many plants on the basis of volatile compounds release by the host plant as their normal process of transpiratio.[12]

Parasitism of Cuscuta reflexa is wrapping around itself over the host plant after attachment with host. Cuscuta makes haustorial connection with the vascular tissue of the host plant. This haustorium is able to penetrate the xylem and phloem of the host plant and attached with tissues of the host plant. Cuscuta reflexa varies in the colour of flowers produced from white to pink. Flowers generally produced in the early summer and autumn but also depend on the species. Seeds are produced in the large quantities. Seeds of Cuscuta reflexa can survive in the soil for many years in the search of host, at this time it depends on the food reserve in endosperm of the seed.[13]

Cuscuta reflexa Roxb. (Convolvulaceae) is an extensive climber parasite. It occurs throughout the plains of India. It is more often called dodder in English. Traditional healers called in Hindi Akash bel in Tamil Akasha Valli. Other names include hell weed, devil's gut, and beggar weed, strangle tare, scald weed, dodder of thyme, greater dodder, and lesser dodder. In Chinese, Cuscuta seeds are called "tu si zi". It has no chlorophyll and cannot make its own food by photosynthesis. Some research studies say that the plant has very low levels of chlorophyll and can slightly photosynthesis. But other species of Cuscuta are entirely dependent on the host plants for nutrition. The stem is thread like filaments it is begin to grow and attach themselves to nearby host plants. The nature plants live its entire life without attachment to the ground. It has long history of ethno medicinal use.

In North India Cuscuta reflexa is usually associated with parasitism in ornamental plants and its occurrence in medicinal crops is unusual. This species is originally from India, is common over the Northern region of the country from the state of UttarPradesh and Uttarakhand. Cuscuta reflexa Roxb. is a valuable medicinal herb Stem

of this plant is antibacterial and used externally to treat itch and internally in fever.[14] It is useful in treatment of androgen induced alopecia. [17] It also gives anti-inflammatory and anti-cancer activity. [16] The aqueous and alcoholic extract of C. reflexa has diuretic property. [17] The crude water extract of C. reflexa also shows anti-HIV activity.[15] It is a parasitic plant completely dependent on host plant for food and nutrition. The organic matter is transported from the phloem of the host to the parasite through the haustorium.[14] It is believed that the parasitic herbs extract healthy and potential sap from host plant and if their host plant is medicinal plants then these parasitic herbs how many similar properties to host plants. Cuscuta species feeding on commonly used medicinal herbs are given special attention by traditional healers.

Fig. 1 Cuscuta reflexa

2 Method and Material

The present study utilized various laboratory materials necessary for sample preparation, extraction, microbial culture, sterilization, and analytical procedures. The materials included Petri dishes, inoculating loops, a Bunsen burner, spreader, gloves, autoclave bags, sterile containers, pipette tips, parafilm, foil paper, spatulas, glass rods, measuring cylinders, 250 mL conical flasks, reagent bottles, test tubes, test tube racks, and droppers. These materials facilitated aseptic handling, preparation of culture media, transfer of samples, and execution of microbiological experiments under controlled laboratory conditions.

2.1 Sample Collection

Fresh samples of tomato **(*Solanum lycopersicum*)** and potato **(*Solanum tuberosum*)** showing visible symptoms of microbial infection, such as spots, rotting, and discoloration, were collected from Indranagar, Dehradun, Uttarakhand. The samples were carefully collected in sterile polythene bags and transported to the laboratory

under hygienic conditions to prevent external contamination. Upon arrival, the samples were washed thoroughly with sterile distilled water to remove adhering dust and debris. Small sections of infected tissues were then aseptically excised using sterile blades and used for the isolation of bacterial strains. All samples were processed within 24 hours of collection to ensure the viability and integrity of the associated microorganisms.

The plant material of *Cuscuta reflexa* was collected from the area surrounding the Forest Research Institute (FRI), Dehradun, Uttarakhand, India, during February 2026 under suitable environmental conditions. The collected plants were thoroughly cleaned to remove soil, dust, and other impurities and were then shade-dried for 6–10 days until complete drying was achieved. The dried plant material was ground into a coarse powder using a mechanical grinder and stored in airtight containers in a cool and dry place until further use. Ethanol was selected as the extraction solvent because of its ability to dissolve a wide range of bioactive compounds, including alkaloids, flavonoids, tannins, and phenolic compounds. Moreover, ethanol is less toxic than methanol and is widely used in biological studies. An ethanol–water mixture (1:1, v/v) was employed for extraction.

Fig. 2 Dry C.reflexa

The extract of *Cuscuta reflexa* was prepared using the Fig.3 Soxhlet extraction method. Briefly, 10 g of the dried powdered plant material was accurately weighed and placed in a cellulose extraction thimble. The thimble was inserted into the Soxhlet apparatus, and extraction was carried out using approximately 200 mL of ethanol in a 500 mL round-bottom flask. The extraction process ensured efficient recovery of phytochemical constituents from the plant material for subsequent antimicrobial studies.

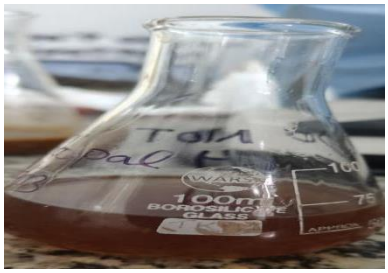


Fig.3 Soxhlet Apparatus **Fig.4 C.reflexa Extract**

2.2 Isolation of Bacteria

Bacteria were isolated from infected tomato **(*Solanum lycopersicum*)** and potato **(*Solanum tuberosum*)** samples by aseptically cutting infected tissues and homogenizing them in sterile distilled water to prepare a microbial suspension. Serial dilutions ranging from 10^{-1} to 10^{-4} were prepared using sterile distilled water to reduce the microbial load and facilitate the isolation of individual colonies.

Nutrient agar medium was prepared and sterilized in an autoclave at 121°C and 15 psi for 15–20 minutes. Approximately 20 mL of sterilized medium was poured into sterile Petriplates under aseptic conditions and allowed to solidify. A volume of 0.1 mL from selected dilutions was spread evenly on the agar surface using a sterile spreader. The inoculated plates were incubated at 37°C for 24 hours, after which distinct bacterial colonies were observed.

2.2.1 Purification of Bacteria

Pure bacterial cultures were obtained using the streak plate method. Isolated colonies from the spread plates were picked with a sterile inoculating loop and streaked onto fresh nutrient agar plates. The plates were incubated at 37°C for 24 hours to obtain well-isolated colonies representing pure bacterial cultures.

2.2.2 Identification of Bacteria

The purified bacterial isolates were identified through Gram staining and microscopic examination. Thin bacterial smears were prepared on clean glass slides, heat-fixed, and sequentially stained with C**rystal violet, Gram's iodine, alcohol, and safranin.** The stained slides were observed under an oil immersion microscope, where Gram-positive bacteria appeared purple and Gram-negative bacteria appeared pink or red.

Nutrient broth was prepared by dissolving peptone, beef extract, and sodium chloride in distilled water, followed by pH adjustment to 7.2–7.4. The medium was sterilized at 121°C for 15 minutes and used for the cultivation and maintenance of bacterial isolates.

2.3 Biochemical Characterization of Isolates

The purified bacterial isolates were subjected to standard biochemical tests to evaluate their metabolic and enzymatic characteristics. These tests assisted in the identification and differentiation of bacterial species and provided important information regarding the biochemical profile of the isolates. The results obtained were compared with standard microbiological characteristics for bacterial identification.

2.3.1 Biochemical Test

The isolated bacterial cultures were subjected to various biochemical tests to determine their physiological and metabolic characteristics. These tests are commonly used for the identification and differentiation of bacterial species based on their enzymatic activities and substrate utilization patterns.

2.3.1.1 Catalase Test

The catalase test was performed to determine the ability of bacterial isolates to produce the enzyme catalase, which decomposes hydrogen peroxide into water and oxygen. The appearance of effervescence (oxygen bubbles) after the addition of hydrogen peroxide indicated a positive result, while the absence of bubbles indicated a negative reaction.

Result-: (+) Presence of catalase enzyme that breaks hydrogen peroxide into water and oxygen; **(-)** enzyme absent.

2.3.1.2 Indole Test

The indole test was carried out to assess the ability of bacteria to degrade tryptophan and produce indole through the enzyme tryptophanase. After the addition of Kovac's reagent, the formation of a red-colored ring on the surface of the medium was considered a positive result.

Result-: (-) Organism cannot produce indole from the amino acid tryptophan.

2.3.1.3 Citrate Utilization Test

This test was conducted to determine whether bacterial isolates could utilize citrate as their sole source of carbon. A change in the color of Simmons citrate agar from green to blue indicated citrate utilization and was recorded as a positive result.

Result-: (+) Organism can utilize citrate as its sole carbon source for growth.

2.3.1.4 Starch Hydrolysis Test

The starch hydrolysis test was performed to evaluate the production of amylase enzyme by the bacterial isolates. After incubation, iodine solution was added to the medium. The formation of a clear zone around the bacterial growth indicated starch degradation and a positive reaction.

Result-: (+) Organism produces amylase enzyme that hydrolyzes starch; **(-)** starch is not degraded.

2.3.1.5 Sugar Fermentation Test

2.3.1.5.1 Dextrose Fermentation Test

The dextrose fermentation test was used to determine the ability of bacteria to ferment glucose. Acid production was indicated by a color change in the medium, while gas production, if present, was observed in the Durham tube.

Result-: (+) Organism ferments dextrose producing acid and/or gas; **(-)** no fermentation occurs.

2.3.1.5.2 Sucrose Fermentation Test

This test was conducted to evaluate the ability of bacterial isolates to ferment sucrose. A change in the indicator color due to acid production indicated a positive fermentation reaction.

Result-: (+) Organism can ferment sucrose as an energy source.

2.3.1.5.3 D-Mannitol Fermentation Test

The D-mannitol fermentation test was performed to determine the utilization of mannitol by bacterial isolates. Fermentation of mannitol resulted in acid production, leading to a visible color change in the medium.

Result-: (+) Organism ferments mannitol producing acidic end products.

2.3.1.5.4 Maltose Fermentation Test

The maltose fermentation test was used to assess the ability of bacteria to ferment maltose as a carbohydrate source. A positive result was indicated by acid production and a corresponding color change in the medium.

Result-: (+) Organism can utilize maltose through fermentation.

2.3.1.6 Nitrate Reduction Test

The nitrate reduction test was carried out to determine the ability of bacterial isolates to reduce nitrate to nitrite or other nitrogenous compounds. The development of a red color after the addition of nitrate reagents indicated a positive nitrate reduction reaction.

Result-: (+) Organism reduces nitrate to nitrite or other nitrogenous compounds.

2.3.1.7 Methyl Red (MR) Test

The methyl red test was performed to detect the production of stable acidic end products during glucose fermentation. The appearance of a red color after the addition of methyl red indicator indicated a positive result, whereas a yellow color indicated a negative reaction.

Result-: (-) Organism does not produce stable mixed-acid fermentation products.

2.3.1.8 Voges–Proskauer (VP) Test

The VP test was conducted to detect the production of acetoin, an intermediate metabolite formed during glucose fermentation. The development of a pink to red color after the addition of VP reagents confirmed a positive reaction.

Result-: (-) Organism does not produce stable mixed-acid fermentation products.

2.3.1.9 Casein Hydrolysis Test

This test was performed to determine the ability of bacterial isolates to produce proteolytic enzymes capable of degrading casein. A clear zone surrounding the bacterial growth on skim milk agar indicated casein hydrolysis and a positive result.

Result-: (+) Organism produces protease enzymes that hydrolyze casein protein; (-) casein remains unchanged.

2.3.1.10 Urease Test

The urease test was carried out to detect the production of urease enzyme, which hydrolyzes urea into ammonia and carbon dioxide. A change in the medium color from yellow-orange to pink indicated a positive urease reaction.

Result-: (+) Organism produces urease enzyme that converts urea into ammonia.

2.3.1.11 Hydrogen Sulfide (H_2S) Production Test

The hydrogen sulfide test was performed to evaluate the ability of bacteria to produce hydrogen sulfide gas during metabolism. The formation of a black precipitate in the medium indicated a positive H_2S production reaction.

Result-: (-) Organism does not produce hydrogen sulfide gas.

2.3.1.12 Motility Test

The motility test was conducted to determine whether bacterial isolates possessed flagella and were capable of movement. Diffuse growth spreading away from the stab line in semisolid agar indicated motility, whereas growth restricted to the inoculation line indicated a non-motile organism.

Result-: (-) Organism is non-motile and lacks active movement.

2.4 Phytochemical Analysis of *Cuscuta reflexa*

Preliminary phytochemical screening of the plant extract was carried out to detect the presence of major bioactive compounds such as alkaloids, tannins, steroids, flavonoids, terpenoids, saponins, and phenolic compounds using standard qualitative methods.

2.4.1 Alkaloid Detection:

The presence of alkaloids was examined using Mayer's and Wagner's tests. In Mayer's test, a small quantity of plant extract was treated with Mayer's reagent (potassium mercuric iodide). The appearance of a cream or pale-yellow precipitate indicated the presence of alkaloids. In Wagner's test, the extract was mixed with Wagner's reagent (iodine-potassium iodide solution), resulting in the formation of a reddish-brown precipitate, confirming the presence of alkaloidal compounds.

Result-: Strong presence of alkaloids, which may contribute to antimicrobial and medicinal activities.

2.4.2 Tannin Detection:

Tannins were identified using ferric chloride and gelatin tests. For the ferric chloride test, the extract was boiled with distilled water, filtered, and treated with ferric chloride solution. The development of a bluish-black or brownish-green coloration indicated the presence of tannins. In the gelatin test, the extract was treated with sodium chloride followed by gelatin solution. The formation of a white precipitate confirmed the presence of tannins due to protein precipitation.

Result-: High amount of tannins present, indicating potential antioxidant and antimicrobial properties.

2.4.3 Steroid Detection:

Steroids were detected using the Liebermann–Burchard test. The extract was dissolved in chloroform and treated with acetic anhydride followed by concentrated sulfuric acid. The formation of a brown ring at the junction of the two layers along with a green coloration in the upper layer indicated the presence of steroidal compounds.

Result-:(+) Steroidal compounds are present in moderate quantity.

2.4.4 Flavonoid Detection:

Flavonoids were tested using alkaline reagent and lead acetate methods. In the alkaline reagent test, addition of sodium hydroxide produced a yellow color that disappeared upon the addition of dilute hydrochloric acid, indicating the presence of flavonoids. In the lead acetate test, the formation of a yellow precipitate after adding lead acetate solution further confirmed the presence of flavonoid compounds.

Result-: (++) Flavonoids are abundantly present and may provide antioxidant and anti-inflammatory effects.

2.4.5 Terpenoid Detection:

The Salkowski test was employed to detect terpenoids. The extract dissolved in chloroform was carefully treated with concentrated sulfuric acid. The appearance of a reddish-brown coloration at the interface of the two layers indicated the presence of terpenoids.

Result-: (+) Terpenoids are present and may contribute to antimicrobial and therapeutic activities.

2.4.6 Saponin Detection:

Saponins were analyzed using the froth test. The extract was vigorously shaken with distilled water and allowed to stand. The absence of stable froth indicated that saponins were not present in significant amounts in the extract.

Result-: (-) Saponins are absent or not detected in the extract.

2.4.7 Phenolic Compound Detection:

Phenolic compounds were identified by ferric chloride and lead acetate tests. In the ferric chloride test, the extract developed a bluish-black coloration upon treatment with ferric chloride solution, indicating the presence of phenols. In the lead acetate test, the extract was treated with ethanolic solution, sulfuric acid, and sodium chloride solution, resulting in a color change from red to blue, which further confirmed the presence of phenolic compounds.

Result-: (++) Phenolic compounds are present in high concentration, suggesting strong antioxidant potential.

2.5 ANTIMICROBIAL ACTIVITY (Minimum Inhibitory Concentration)

The antibacterial activity of *Cuscuta reflexa* extract was evaluated by measuring the diameter of the zone of inhibition against the tested bacterial isolates. The results demonstrated that all samples exhibited varying degrees of antibacterial activity, indicating the presence of bioactive phytoconstituents capable of suppressing microbial growth. The zone of inhibition ranged from **7 mm to 16 mm**. Among the tested samples, **Sample D** showed the highest antibacterial activity with a zone of inhibition of **16 mm**, followed by **Sample B (15 mm)** and **Sample C (13 mm)**. **Sample A** exhibited the lowest inhibitory effect with a zone of inhibition of **7 mm**. The observed antimicrobial activity suggests that *Cuscuta reflexa* possesses significant antibacterial potential and may serve as a promising natural source of antimicrobial compounds for further pharmacological investigation and development.

2.6 Drug Production

2.6.1 Herbal Capsule Formulation

The ethanolic extract of *Cuscuta reflexa* was formulated into hard gelatin capsules for convenient oral administration. The dried extract was finely powdered and mixed with suitable excipients such as lactose or micro-crystalline cellulose to improve flow properties and ensure uniformity. A small amount of starch paste or Aloe vera gel was added as a binder to enhance cohesiveness. The resulting mixture was dried, sieved to obtain

uniform granules, and manually filled into hard gelatin capsules. The prepared capsules were properly sealed and stored in airtight containers under cool and dry conditions until further use.

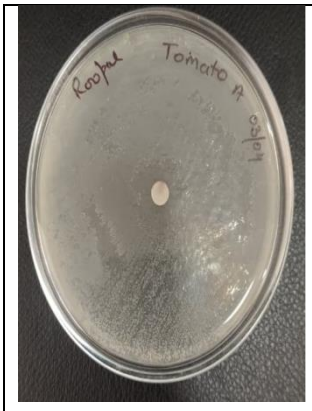
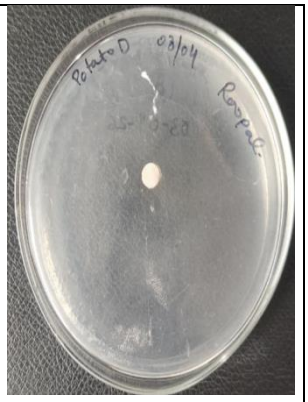
2.6.2 Observation

The formulated capsules showed uniform filling, good appearance, and satisfactory physical stability. The capsules were found to be suitable for oral administration and exhibited a **disintegration time of approximately 8 minutes**, indicating efficient dissolution and release of the herbal extract. These results suggest that the formulation possesses acceptable pharmaceutical characteristics for oral dosage administration.

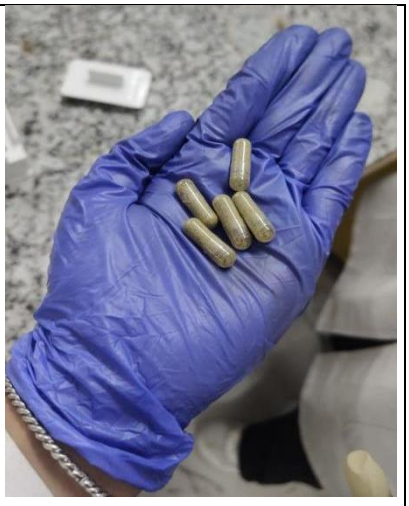
3 Result

3.1 MIC (Minimum Inhibitory Concentration)

Antimicrobial activity against sample A, Sample B, Sample C and Sample D

			
Zone of inhibition 7mm	Zone of inhibition 15mm	Zone of inhibition 13mm	Zone of inhibition 16mm

3.2 Drug Production

		
Accurate weighing of dried ethanolic extract of cuscuta reflexa.	Preparation and filling process of herbal capsule formulation.	The ethanolic extract of Cuscuta reflexa was successfully formulated into hard gelatin herbal capsules using suitable excipients. The prepared capsules were uniform, stable, and appropriate for further pharmacological evaluation.

3.3 Classification of bacteria

Classification of Bacteria				
Taxonomic rank	Tomato (A)	Tomato (B)	Potato (C)	Potato (D)
Domain	Bacteria	Bacteria	Bacteria	Bacteria
Phylum	Pseudomonadota	Pseudomonadota	Pseudomonadota	Pseudomonadota
Class	Gammaproteobacteria	Gammarprotebeobacteria	Gammarprotebeobacteria	Gammarprotebeobacteria
Order	Enterobacterales	Enterobacterales	Enterobacterales	Enterobacterales
Family	Enterobacteriaceae	Enterobacteriaceae	Enterobacteriaceae	Morganellaceae
Genus	Klebsiella	Enterobacter	Serratia	Proteus
Species	Klebsiella pneumoniae	Enterobacter cloacae complex	Serratia marcescens	Proteus vulgarism

4 Discussion and Conclusion

The current investigation was conducted to assess the antimicrobial potential of Cuscuta reflexa Roxb. against bacterial isolates recovered from tomato and potato plants. The findings revealed that the plant extract was capable of suppressing the growth of the tested bacterial isolates, suggesting the presence of biologically active compounds with antibacterial properties. The antimicrobial effect observed in this study may be associated with the phytochemical constituents of Cuscuta reflexa, including flavonoids, alkaloids, tannins, phenolics, and terpenoids, which are known to possess antimicrobial activities.

The variation in antibacterial activity observed among different bacterial isolates indicates differences in their sensitivity to the plant extract. These differences may arise from variations in bacterial cell structure, physiological characteristics, and resistance mechanisms. The outer membrane present in Gram-negative bacteria often reduces the penetration of antimicrobial agents, making them relatively more resistant. Nevertheless, the inhibitory effect demonstrated by Cuscuta reflexa extract against the tested isolates highlights its potential as a promising natural antimicrobial agent.

The results obtained in this study are in agreement with earlier reports that have documented the antimicrobial efficacy of Cuscuta reflexa against various microbial pathogens. The observed antibacterial activity supports the traditional use of this medicinal plant and suggests that it could serve as a sustainable alternative to synthetic

antimicrobial compounds. Further investigations are required to isolate, identify, and characterize the specific bioactive constituents responsible for the antimicrobial activity and to evaluate their mechanisms of action.

Based on the findings of the present study, it can be concluded that Cuscuta reflexa Roxb. exhibits considerable antibacterial activity against bacterial isolates obtained from tomato and potato plants. The plant extract effectively restricted bacterial growth, indicating its potential as a valuable source of natural antimicrobial compounds. These results reinforce the traditional medicinal significance of Cuscuta reflexa and suggest its possible utilization in developing environmentally friendly antimicrobial products and plant disease management strategies. Future studies should focus on detailed phytochemical analysis, purification of active compounds, toxicity evaluation, and large-scale field trials to validate its practical applications in agriculture and pharmaceutical research.

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BIOPROSPECTING NARMULI

ANTIMICROBIAL ACTIVITY AGAINST BACTERIAL ISOLATES FROM

TOMATO AND POTATO

SIGNIFICANCE

- Supports sustainable agriculture through plant-based microbes
- Helps reduce reliance on synthetic chemicals
- Promotes plant health and food security
- Encourages bioprospecting of underutilized aquatic plants

KEY HIGHLIGHTS

- Narmuli extract shows significant antimicrobial activity against selected bacterial pathogens.
- Effective against bacterial isolates from tomato and potato
- Evaluated using standard *in vitro* antimicrobial assays.
- Highlights the potential of Narmuli as a natural and sustainable solution.

> Exploring nature's potential for a healthier tomorrow.

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