# Antimicrobial Potential of Ipomoea Aquatica, Allium Fistulosum and Cucurbitamoschata Against Staphylococcus Aureus, Pseudomonas Aureginosa and Escherichia Coli

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**Abstract**
Vegetables are comparatively cheaper and rich sources of vitamins. Green leafy vegetables are an important part of our healthy diet. They are rich in antioxidants (natural source of fibers) and also supportimproving inflammatory response, optimal brain function, bone health and making skin glow, etc. This research aimed to determine the phytochemical analysis and antimicrobial activity of *Ipomoea aquatica* (Water spinach), *Allium fistulosum* (Green onion), and *Cucurbitamoschata*(Pumpkin) against gram-positive bacteria (*Staphylococcus aureus*)and gram-negative bacteria (*Escherichia coli* and *Pseudomonas aureginosa).*The solvent used for the extraction weacidsthanol, water, and petroleum ether, where ethanol is polar, water is aquas and petroleum ether is non-polar. Phytochemical screening to determine the existence of alkaloids, carbohydrates, proteins,glycosides, cardiac glycosides, amino acid, flavonoids, tannin, terpenoids, quinone, phlobatannins, saponin, and phenolic compounds. All plant leaves extracts were shown antibacterial activity against test pathogenic bacteria.
**Keywords**: Antimicrobial activity, phytochemical, analysis, *Ipomoea aquatica, Allium fistulosum, Cucurbitamoschata.*

**Introduction**
Now a day infectious diseases are the major leading causes of death seen in globally. Many infectious diseases were treated with the herbal remedies (1). Since a long time ago plants and plant products are very useful sourcesof pharmacology active substances and medicines (2). In this study, we can take three leafy vegetables namely*Ipomoea aquatica* (Water spinach), *Allium fistulosum* (Green onion), and *Cucurbitamoschata*(Kaddu).*Ipomoea aquatica*forskbelongs to the Convolvulaceae family. Generally, it grows in wild regions and widely consumed vegetable in the Southeast Asia region (3). Naturally, biologically active compounds are present in plants proved by phytochemical tests. These compounds are responsible for color and organoleptic properties in plants (4).*Ipomoea aquatica*forsk naturally synthesized and accumulate some secondary metabolites like tannin, alkaloids, glycosides, volatiles oil and minerals and vitamins possess medicinal properties (5).It is also possess an insulin like activity (6).Traditionally it is used in various treatments like nervous and general debility, worm infections, piles, leucoderma, jaundice, leprosy and liver complaints (7).

*Allium fistulosum* is the biggest and most important ideal genus of the Alliaceae family (8). It is a spicy vegetable herb of tropical regions of northern hemisphere which is used extensively to flavor up the soups, steamed, fried, dals, salads and other cookeries. It is a vegetable with many medicinal properties oftenserves as a food flavorant (culinary function) and for therapeutic use such as eyesight problems, headaches, common cold, wounds, heart problems and festering sores (9-10). The *Cucurbitamoschata* belongs to Cucurbitaceae family. It is most important food with several therapeutic characteristics including anti-oxidant, anti-tumor, anti-diabetic, anti-cancer, anti-hyperlipidemic, anti-microbialand anti-inflammatorycapabilities, they also promote immunological function. (11-13).

## Materials and Methods

**Collection of leaves and test organisms**
Fresh leaves of *Ipomoea aquatica* (Water spinach), *Allium fistulosum*(Green onion) and *Cucurbitamoschata*(Pumpkin) weregathered from the local market of Bhilai, Chhattisgarh, India, these vegetable leaves are popular by their

common names such as karmattabhaji,pyajbhaji and kumhadabhaji respectively. The test culture Gram negative bacteria (*Escherichia coli*and *Pseudomonas aureginosa*) and Gram positive bacteria (*Staphylococcus aureus*)was collected from SSIMS (Shri ShankaracharyaInstitute of Medical Sciences)Junwani Bhilai Chhattisgarh India.

**Preparation of Extraction**

Test plant leaves were thoroughly rinsed with running tap water then blotted and air dried. After drying make a powder using a grinder. After that10g of powdered material were soaked in 50ml of water, ethanol and pepetroleum ether separately at 25ºC temperature for 24 hours at 140rpm under shaking conditions. The extract was filtered using a cheese (muslin) cloth and dried atlaboratory temperature (14).

**Phytochemical Screening**

The water,ethanol, and petroleum ether extract were used to screen chemical tests to identify the chemical constituents of the investigated plants (15-16).

**1) Wagner's test for alkaloids:** Wagner's reagent (iodine-potassium iodide solution) was applied to1 ml of plant extract. The presence of alkaloids is indicated by the reddish-brown precipitate.
**2) Molisch test for carbohydrate:** Molisch reagent, which contains concentrated sulphuric acid and α-naphthol, was applied to 1 ml of plant extract. A junction or interface between two liquids forms a violet tint when carbohydrates are present.
**3) Keller-Kiliani test for Cardiac-Glycosides:** 1 ml of plant extract was treated with Keller-Kilianireagent. The presence of cardiac glycosides is indicated by the formation of brown color in the acetic acid layer.
**4) Millon's Test for protein:** One milliliter of plant extract was mixed with a few drops of Millon's reagent. The presence of proteins is indicated by a white precipitate.
**5) Ninhydrin test for amino acid:** One milliliter of the plant extract was combined with a few drops of the ninhydrin reagent. Purple is a sign of the presence of amino acids.
**6) Alkaline test for flavonoids:** One milliliter of plant extract receives 1–2 drops of sodium hydroxide solution. The formation of acute yellow color, which indicates the presence of flavonoids, turns colorless with the addition of a few drops of HCL.
**7)Braymer's test for tannin:** 10 percent alcoholic ferric chloride solution was given 1 ml of plant extract to react with. The presence of tannins is indicated by the solution taking on a blue-greenish hue.
**8) Salkoski test for terpenoids:** 5ml of plant extract were treated with 3ml of concentrated sulfuric acid and 2ml of chloroform. The interface's reddish brown coloring was a sign that terpenoids were present.
**9) Concentrated HCL test for quinone:** With concentrated HCl, 1 ml of plant extract was treated. Quinones are present because of the color's formation in the green.
**10) Concentrated HCL test for phlobatannins:** 1ml of plant extract was boiled after being given time to react with 1 percent HCl. Phlobatannins can be detected by the red precipitate that forms when they are present.
**11) Foam test for saponin:** After vigorously shaking a mixture of 5 ml of distilled water and plant extract, saponin was detected as a persistent foam.
**12) Bromine-water test for phenolic:** 1 milliliter of bromine-treated water added to plant extract. A phenolic compound is present when white precipitates appear.

**Antibacterial Activity**

In the present study water, ethanol, and petroleum ether extract of *Ipomoea aquatica*, *Allium fistulosum,* and *Cucurbitamoschata*were used to find out their antibacterial activity by agar well diffusion technique (14).

**Result**

Ethanol, water and petroleum extract of *Ipomoea aquatica*, *Allium fistulosum* and *Cucurbitamoschata* were tested for the presence of phytochemical compounds. According to results all extract of the *Ipomoea aquatica*leaves contained alkaloid, carbohydrate, cardiac-Glycosides, flavonoids and terpenoids. Both extract of ethanol and water showed amino acid and tannin and separately water extract showed quinone and phenolic contents whereas ethanol extract showed protein. All extract of *Ipomoea aquatica*were not shown phlobotannins and saponin. All extract of *Allium fistulosum* leaves showed alkaloids, carbohydrates, flavonoids, and terpenoids. The amino acid was present in both ethanol and water extract. Cardiac-Glycosideswere present in ethanol and

petroleum ether extract. Quinone and phenol werepresent in the water extract. Only saponin, tannin, and protein are present in ethanol extract.All extract of *Cucurbitamoschata*contains alkaloids. Ethanol and water extract showed the presence of amino acid, saponin, and phenolic content. Cardiac-Glycosidesare present in both ethanol and petroleum ether extract. Only ethanol extract showedthe presence of protein, tannin, and terpenoids. Carbohydrates and flavonoids are present in petroleum extract and water extract. Only water extract showsthe presence of quinone(Table No. 01).*Ipomoea aquatica*, *Allium fistulosum,* and *Cucurbitamoschata* all of the leaves water, ethanol, and petroleum ether extract showed antibacterial activity against test pathogenic bacteria(Figure No. 01).

**Table No. 01: Preliminary phytochemical screening of the three extracts of *Ipomoea aquatica*, *Allium fistulosum,* and *Cucurbitamoschata*.**

| S. No. | Phytochemical Test | *Ipomoea aquatica* | | | *Allium fistulosum* | | | *Cucurbitamoschata* | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Water | Ethanol | Petroleum ether | Water | Ethanol | Petroleum ether | Water | Ethanol | Petroleum ether |
| 1. | Alkaloids | + | + | + | + | + | + | + | + | + |
| 2. | Carbohydrate | + | + | + | + | + | + | + | - | + |
| 3. | Cardiac-Glycosides | + | + | + | - | + | + | - | + | + |
| 4. | Protein | - | + | - | - | + | - | - | + | - |
| 5. | Amino acid | + | + | - | + | + | - | + | + | - |
| 6. | Flavonoids | + | + | + | + | + | + | + | - | + |
| 7. | Tannin | + | + | - | - | + | - | - | + | - |
| 8. | Terpenoids | + | + | + | + | + | + | - | + | - |
| 9. | Quinone | + | - | - | + | - | - | + | - | - |
| 10. | Phlobatannins | - | - | - | - | - | - | - | - | - |
| 11. | Saponin | - | - | - | - | + | - | + | + | - |
| 12. | Phenolic | + | - | - | + | - | - | + | + | - |

**Figure No. 01: Antibacterial activity of *Ipomoea aquatica*, *Allium fistulosum,* and *Cucurbitamoschata* against *Staphylococcus aureus,Pseudomonas aureginosa,* and *Escherichia coli*.**

**Discussion**

In the study, we tested the presence of different phytochemical compounds with ethanolic, water, and petroleum ether extract in different vegetable leaves such as *Ipomoea aquatic,Allium fistulosum,* and *Cucurbitamoschata*. All extracts showed inhibition against bacteria *i.e. Staphylococcus aureus,Pseudomonas aureginosa,* and *Escherichia coli*. Similarly, results were found by the other Researchers in different extracts. Shamli and Chandra (2015) studied acetone and petroleum ether extract of *Ipomoea aquatica* showed inhibition against the growth of *Escherichia coli*, *Salmonella typhy*,*Bacillus cereus,* and *Staphylococcus aureus*(17).Saptiani*et al.* (2016) observed the ethanol and water

extract of *Ipomoea aquatica* inhibit the growth of *Escherichia coli*, *Saprolegniaspp*., *Pseudomonas spp*., and*Aeromonashydrophila* (18). Kehinde*et al*. (2019) studies on water extract of *Ipomoea aquatica*. The extract were shown inhibition action against *Escherichia coli*,*Vibrio anguillarum*, *Pseudomonas flurescens*, *Aeromonashydrophilia* and *Salmonella typhi* (14).

Chehregani*et al*. (2007) studied on water extract of *Allium* species (from Hamedan- Iran) extract. The extract were shown inhibition against *Shigellaflexinix* PTCC 1234, *Klebsiellapneumoniae* PTCC 1053, *Bacillus subtilis* PTCC 1365, *Bacillus cereus* PTCC 1247, *Staphylococcus aureus* (Lio) and *Escherichia coli* PTCC 1330 (19).Shinkafi and DaUDA (2013) observed the *Allium cepa* (onion) cold water extract inhibited some pathogenic bacteria such as *Staphylococcus aureus*, *Escherichia coli*, *Streptococcus pyrogenes,* and *Streptococcuspneumoniae* (20). Oyawoye*et al*. (2022) studied water and ethanol extract of *Allium cepa*inhibitedthe bacterial cultures *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcusepidermidis*,*Klebsiellapneumonia,* and *Proteus vulgaris* (21).

Gloria *et al*. (2017) studied the methanol extract of *Cucurbitamoschata*, which can inhibit the growth of *Staphylococcus spp.* (22). Jayasundara*et al*. (2018) studied ethyl acetate and acetic acid extract of *Cucurbitamoschata*. Bothextractswere inhibitedby *Escherichia coli*,*Staphylococcus aureus,*and *Bacillus subtilis*(23). Hussain *et al*. (2021) investigated the 80% methanol extract of *Cucurbita maxima*, which can actively inhibit the growth of *Escherichia coli*,*Salmonella typhi*, *Bacillus subtilis,*and *Staphylococcus aureus* as well as also showing the fungal strains growth (24).

## Conclusion

*Ipomoea aquatica,Allium fistulosum,* and *Cucurbitamoschata* are the most nutrious and medically important vegetables, which has been consumed from the ancient time and also used in different remedies. Based on the aimed study, it can be concluded that the all ethanolic, water and petroleum ether extracts of *Ipomoea aquatica,Allium fistulosum* and *Cucurbitamoschata* leaves contain different types of phytochemical compounds that is through to be the responsible for their antibacterial activity.

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## Conflict of interest

The authors declare that there is no conflict of interest.

## Author's contribution

Lalima Kumbhkarcarried out the study, collected the data and framed the manuscript. Dr. RachanaChoudhary and Rachana Tiwari contributed in scientific planning and review of the manuscript. Dr. Bhuneshwari Nayak wrote the manuscript. All authors read and approved the final manuscript for publication.

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## Data availability

All databases analyzed or generated during this study are included in the manuscript.

## Ethics statement

Not applicable.

## References

1. Bhattacharjee A, Devi S, Pramodini K. Antibacterial activity and phytochemical analysis of *Ipomoea aquatica*forsk. *Int. J. Sci. Res*. 2018;9(5):26938-26941.
2. Aravind G, Bhowmik D, Duraival S, Harish G. Traditional of medicinal uses of *Carica papaya*. *J. Med. Plants. Stud.* 2013;1(1):7-15.

3. Sivaraman D, Murlidaran P, Kumar SS. Evaluation of anti-microbial and anti-inflammatory activity of methanol leaf extract of *Ipomoea aquatica*Forsk.*Res. J. Pharm. Biol. Chem. Sci*. 2010;1(2):258-264.
4. Ramaswamy L, Kanmani GM. Phytonutrient profile, Health benefits and culinary applications of selected edible foliages. *Int. J. Ayurvidic Herb. Med*. 2012;2(3):469-476.
5. Hafiz FB, Towfique NM, Sen MK, ShamimaNasrinSima SN, Azhar BS, Rahman MM. A comprehensive ethano-pharmacological and phytochemical update review on medicinal plant of *Terminaliaarjuna*Roxb of Bangladesh. *Sch. Acad. J. Pharma*. 2014;3(1):19-15.
6. Huang DJ, Chen HI, Lin CD, Lin YH. Antioxidant and anti-proliferative activities of water spinach (*Ipomoea aquatica*Forsk) constituents. *Bot. Bull. Acad. Sin*. 2005;46:99-106.
7. Chaudhury IH, Das T, Saha D. Preliminary phytochemical screening and antimicrobial activity of ethanolic extract of stems of *Ipomoea aquatica*Forsk (Family- Convolvulaceae). *Int. J. Curr. Pharm. Res*. 2017;9(4):109-113.
8. Guarrera PM, Savo V. Perceived health properties of wild and cultivated food plants in local and popular traditions of Italy: a review. *J. Ethanopharmacol*. 2013;146(3):659-680.
9. Singh BK, Ramakrishna Y. Welsh onion (*Allium fistulosum* L.): A promising spicing-culinary herb of Mizoram. *Indian J. Hill Farming*. 2017;30(2):201-208.
10. Yadav Y, Jain S, Tomar R, Prasad GBKS, Yadav H. Medicinal and biological potential of pumpkin an updated review. *Nutr. Res. Rev*. 2010; 23:184-190.
11. Abd El-Aziz AB, Abd El-Kalek HH. Antimicrobial proteins and oil seeds from pumpkin (*Cucurbitamoschata*).*Nat. Sci*. 2011;9:105-119.
12. Jacob-Valenzuela N, Marostica MRJ, Zazueta JJM, Gallegos JAJ. Physicochemical technological properties and health-benefits of *Cucurbitamoschata*, DuchensevsCehualea.*Int. Food Res. J*. 2011;44:2587-2593.
13. Kehinde AS, Adelakum KM, Attahiru H, Adedeji AS, Akinade GT. Antibacterial activities of crude extract of *Ipomoea aquatica* (water spinach) against fish pathogens. *Res. Rev.:J. Ecol. Environ*. 2019;7(1):1-3.
14. Marka R, Talari SP, Rudroju S, NannaSwamy R. Preliminary phytochemical analysis of leaf, stem, root, and seed extracts of *Arachishypogaea* L. *Int. J. Pharm. Scl. Rev.*2013;22:134-139.
15. Shaikh RJ,Patil MK. Qualitative test for preliminary phytochemical screening: An overview. *Int. J. Chem.Stu.*2020;8(2):603-608.
16. Shamli M, Chandra JH. Evaluation of antibacterial activity of different solvent extracts of medicinal plant *Ipomoea aquatica*forsk. *J. Chem. Pharma. Sci*. 2015;8(1):52-54.
17. Saptiani G, Hardi EH, Pebrianto CA, Agustina, Ardhani F. Antimicrobial potential of *Carica papaya*, *Ipomoea aquatica*, *Alpiniagalanga* and *Piper betle* against aquatic microbials. *Nus. Biosci*. 2016;8(2):252-257.
18. Chehregani A, Azimishad F, Alizade HH. Study on antibacterial effect of some *Allium* species from Hamedan- Iran. *Int. J. Agric. Biol*. 2007;9(6):873-876.
19. Shinkafi SA, Dauda H. Antibacteria activity of *Allium cepa* (onion) on some pathogenic bacteria associated with ocular infections. *Sch. J. App. Med. Sci*. 2013;1(3):147-151.
20. Oyawoye OM, Olatu TM, Nzekwe SC, Idowu JA, Abdullahi TA, Babatunde SO, Ridwa IA, Batiha GE, Idowu N, Alorabi M, Faidah H. Antioxidant potential and antibacterial activities of *Allium cepa* (onion) and *Allium sativum* (garlic) against the multidrug resistance bacteria. *BNRC*. 2022;46(214):1-7.
21. Gloria LL, Oliveira DB, Vieira-Da-Motta O, Samarao SS, Pinheiro LZ, Bernardes NR, Rodrigues R, Santos JO. In vitro antioxidant and antibacterial activity of pumpkin (*Cucurbitamoschata*) pulp. *Rev. Bras. Pl. Med*. 2017;19(2):274-280.
22. Jayasundara CW,Deraniyagala SA, Hettiarachchi CM, Thiripuranathar G. Antioxidant and antibacterial activities of leaves, skin, flesh and seeds of Sri Lankan variety of *Cucurbitamoschata*.*Int. J. Ayurveda Res*. 2018;6(3):1-7.
23. Hussain A, Kausar T, Din A, Murtaza A. Antioxidant and antimicrobial properties of pumpkin (*Cucurbita maxima*) peel, flesh and seed powders. *J. Biol. Agric. Healthcare*. 2021;11(6):42-51.