Research Article

Phytochemical analysis and antimicrobial activity of *Alternanthera paronychioides* A.St.-Hil.-A smooth Joyweed

Niranjan M. H., Prabhurajeshwar C.*

Associate Professor Department of Studies in Biotechnology, Davangere University, Davangere-577007, Karnataka, India

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Abstract

Objective: *Alternanthera paronychioides* A.St.-Hil. is belongs to the family Amaranthaceae. A native of tropical America becoming widespread as an introduced weed in India, Java and other parts of the old world tropics. The objective of the study of this plant is to determine the bioactive chemical constituents and to evaluate leaf and stem crude extracts for *in vitro* antimicrobial activities by agar disc diffusion method. **Material and methods:** Phytochemical analysis of the crude extracts of leaf and stem parts revealed the presence of tannins, saponins, anthraquinones, glycosides, flavonoids and reducing sugar. **Results and conclusion:** The crude extracts leaf and stem were showed effective against the *Staphylococcus aureus, Escherichia coli, Salmonella typhi and Bacillus subtilis.* The minimum inhibitory concentrations (MIC) of the crude extracts were determined for the various organisms which ranged between 5.0 and 37.0 mg/ml. These results have showed that *Alternanthera paronychioides* leaf and stem crude extracts had significant activity against all organisms tested.

Keywords: *Alternanthera paronychioides,* Phytochemical analysis, Antimicrobial activity, Smooth joy weed

Introduction

The traditional system of herbal medicine are considered as the rich sources of lead compounds which are eco-friendly and quite safe for human use and has become a topic of global importance. The use of plants and plant products as medicines could be traced as far back as the beginning of human civilization. The earliest mention of medicinal use of plants in Hindu culture is founds in “Rig-Veda”, which is said to have been written between 4500-1600 B.C. and is supposed to be the oldest repository of human knowledge. It is Ayurveda, the foundation of medicinal science of Hindu culture, in its eight division deals with specific properties of drugs and various aspects of science of life and the art of healing (Lalitha Sree, 2016). Nearly 80% of the world's population relies on traditional medicines for primary health care, mast of which involve the use of plant extracts. In India almost 95% of the prescriptions were used in Unani, Ayurveda, Homeopathy and Siddha. Phytochemicals are responsible for medicinal activity of plants. These are non-nutritive chemicals that have protected human from various diseases. The anti-inflammatory, antispasmodic, anti-analgesic and can be attributed to their high steroids, tanning, terpenoids and saponins (Sunil, 2008). India is known for its rich diversity of medicinal plants and from ancient times these plants were utilized as therapeutic agents. Today's research is mainly focused on medicinal plants because the bioactive compounds and medicinal power mainly depends on phytochemical constituents that have great pharmacological significance (Marcos et al., 2004).

The phytochemical constituents, natural bioactive compounds, nutrients and fibers present in medicinal plants, fruits and vegetables defend us from various ailments. Phytochemicals are classified into two major groups namely primary constituents like amino acids, sugars, proteins and chlorophyll etc. secondary constituents includes alkaloids, essential oils, flavanoids, tannins, terpenoids, saponins and phenolic compounds etc., more over they bear valuable therapeutic activities (Niranjan, 2020).

According to World Health Organization, for their preliminary health care, 80% ofworld's population depends on traditional medicine.Medicinal properties of several

Address for Corresponding Author:
Dr. Prabhurajeshwar
Assistant Professor Department of Studies in Biotechnology, Davangere University, Davangere-577007, Karnataka, India
E-mail: p.v.chidre@gmail.com, prabhu.an@davangereuniversity.ac.in

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herbal plants and the herbal extracts used to curevariety of diseases are documented in ancient Indian literature. Medicinal value ofthese plants lies in some bioactive substances that produce a definite physiologicalaction on human body (WHO, 2005 and Vimalanalinakumari, 2016). Phytochemicals are not essential nutrients and are required by the human body forsustaining life, but have important properties to prevent or to fight some commondiseases.They protect plants from disease and damage and contribute to the plants color, aroma and flavour. In general, the plant chemicals from environmental hazards such aspollution, stress, drought, UV exposure and pathogenic attack are called asphytochemicals.

Natural products are the source of synthetic and traditional herbal medicine. Themedicinal importance of plant due to the presence of some special substances likealkaloids, glycosides, tannins, flavonoids, saponins etc., Soxhlet apparatus, and crud extraction was used for the organic extraction. Solvents used were petroleum ether, ethyl acetate and methanol (Niranjan, 2020).

Materials and Methods

About Plant

Common name : (Smoothjoyweed)
Division :Magnoliophyta
Class :Rosopsida
Subclass :Caryophyllidae
Order :Caryophyllales
family : Amaranthaceae
genus : Alternanthera
species : *Alternanthera paronychioides* A. ST. HIL.

Plant Description

Habitat: Herbs, perennial, 1-8 dm

Stem: Stems prostrate, villous and glabrate.

Leaves: Sessile; blade elliptic, ovate-rhombic, or oval, 0.6-2.5 × 0.3-1.1cm, apex acute or obtuse, villous, soon glabrate Inflores-cences: axillary, sessile; heads white, globose, 0.5-1cm diam.; bracts lessthan 1/2 as long as tepals. Flower:-tepals monomorphic, white, lanceolate, 3-5mm, apex acuminate, without rigid, spinose tips, hairs not barbed; stamens 5; anthers 3-5, globose;pseudostaminodesligulate, shorter than filaments, margins entire or dentate. Utricles included within tepals, stramineous, orbiculate to rounded-obovate, 2-2.3mm, apex truncate.

Seeds: Lenticular, 1.2-1.5mm.

Uses: In Sri Lanka, the plant is used in salads. They also use it for the treatment ofbiliousness, dyspepsia and sluggish liver. Alternanthera paronychioides is used in local medicine in Taiwan, along with other medicinal plants, to treat hepatitis, tightchest, bronchitis, asthma and other lung troubles. Alternanthera paronychioides protects pancreatic β-cells from glucotoxicity by its antioxidant, antiapoptotic and insulin secretagogue actions.

Figure 1. Habitat of *Alternantheraparonychioides*A.ST.-HIL

Plant Collection

Collection of plant material Fresh and healthy ,disease free, leaves of *Alternanthera paronychioides*were collected from Thadimalngi, T. Narasipura taluk, Mysore district, Karnataka state, India (Figure 1).

Preparation of leaf and stem extracts

The aerial parts of plant fresh leaves and stem of *Alternanthera paronychioides* leaves were 2 times washed thoroughly under running tap water and at last rinse with sterile distilled water to remove the dirt and dried .under

Figure 2. A. *Alternanthera paronychioides* leaves; B: *Alternanthera paronychioides* stem; C: *A. paronychioides* leaves powder; D: *A. paronychioides* stem powder

shade dried at room temperature.The dried leaves were powdered in a blender leaves were powder in a blender or mixer grinder until fine coarse powder obtained and stored in air tight container at stored in room temperature and them used for crude extraction (Ramamurthy, 2013), (Figure 2).

*A.paronychioides*leaves and stem extract using three types of solvents (methanol, ethanol, aqueous). Fine powder of leaves and stem (40gm) was extracted in 100 ml of ethanol, methanol, aqueous at 50-55°C for 24 hours in rotary shaker. The extract was filtered through Whatman filter paper No.1 and then concentrated by using a rotary evaporator at low temperature (40-50°C) and reduced pressure. Further, the driedresidue was preserved in airtight container and kept at 4-5°C until further use (Tiwari, 2011; Keener, 2021).

Yield of extracts

After the concentrate extract obtained from the rotary evaporator, they were collected in the vials. Extract were dried in the room temperature until the dried powder left in vials. Each vial is weighed to calculate the plant extract in the dry form. From that dry form one gram of dried powder is diluted in 10 ml of respective solvents to test against microorganisms at different concentration (Sukanya, 2009).

Phytochemical test

Different extracts of *Alternanthera paronychioides* leaves and stem were subjectedto phytochemical analysis to detect the presence of some active chemical compound. Chemical test were carried out to identity the presence of phytoconstituents in ether, methanol, aqueous extracts using standard procedure of Ahmad, 2001 and Niranjan, 2020, following qualitative tests were conducted in the laboratory to confirm pressure and absence of phytoconstituents.

Test for Carbohydrates

Benedict Test: 1ml of extract was treated with Benedict's reagent and heated gently orange red precipitate indicates presence of reducing sugar.

Test for Saponins

Froath test: Extract was treated with distil water to 20 ml and this was shaken in graduated cylinder for 15 min resulting in the formation of 1cm layer of foam indicates the presence of saponins.

Test for Tannins

Iodinetest: Leaves and bark extract were treated with dil Iodine solution andappearance of transient red color indicates presence of tannins.

Test for Proteins

Biuret test: Leaves and bark extracts were treated with 1ml NaOH (10%) solution is added. A violet color indicates the presence of proteins.

Test for alkaloids

Take 500mg of leaf powder and stirred with 5 ml of dilute.HCL filtered and each testin done by following process.

Hager'stest: A filtrate was treated with hanger's reagent saturated picric acid solution, in the presence of alkaloids conformed by formation yellow color precipitate.

Test for Flavonoids

Lead acetate: Extract was treated with few drops of lead acetate solution. Formation of yellow color precipitate indicates the presence of flavonoids.

Test for Glycoside: 0.2 g of extract is dissolved in 1 ml of glacial acetic acid containing 1 drop of ferricchloride solution then 1 ml of concentration sulphuric acid is added slowly. A brownring obtained at the interforce indicates the presence of glycosides.

Test for Anthraquinones test: About 0.5g of extracts was taken in test tube and 5 ml of chloroform was added andshaken for 5 min. The extracts were filtered. The filtered shaken with equal volume of10% ammonia solution .A pink violet/ red color in the ammonia layer indicates the presence of anthraquinones.

Antimicrobial Activity of *Alternanthera paronychioides* A.ST.-HIL.leaves and stem

Antimicrobial assay of extracts of different plants was performed by agar well diffusion method in Mueller Hinton Agar (MHA) plates. The test organismswere obtained from Department of Botany, Manasa Gangotri Mysore, inoculated in Nutrient broth and incubated overnight at 37°C to adjust the turbidity to 0.5 McFarland standards solution. MHA plate was lawn cultured with standardized microbial culture broth. Plant extracts of 50 mg/ml concentration were prepared; wells of 6 mm were bored in the inoculated media with the help of sterile cork-borer. Each well was filled with 50 μl extracts from different plants: with positive and negative control respectively. It was allowed to diffuse for about 30 minutes at room temperature and incubated for 18-24 hours at 37°C. After incubation, plates were observed for the formation of a clear zone around the well which corresponds to the antimicrobial activity of tested compounds. The zone of inhibition (ZOI) was observed and measured in mm (Niranjan, 2020).

Results and Discussion

Phytochemical studies

The preliminary qualitative phytochemical screening of

leaf and stem extract showed the presence of phytochemical substances such as ethanol, aqueous and methanol extracts indicated the presence of alkaloids, Anthraquinones, proteins flavonoids, saponins, tannins, carbohydrates and reducing sugar Anthraquinones. Phytochemicals or secondary metabolites usually occur in complex mixtures that different among plant organs and stages of development.

Knowledge of the phytochemical constituents present in *A. paronychioides*will be very useful for the maximum exploitation of this plant in medicine. Preliminary phytochemical screening of *A.paronychioides* leaf and stem extracts revealed the presence of various bioactive compounds and the results were summarized in Table 1 and 2.

The phytochemical screenings of *A.paronychioides*. shows the presence carbohydrates, saponins, tannins, glycoside, reducing sugar of all major phytochemicals of in appreciable amount and other components in moderate amount. Whereas flavonoids, protein, and are absent. The maximum result in glycoside both leaves and stem extract of *A.paronychioides* and moderate results shown in reducing sugar, in aqueous leaves extract and stem ethanol extract .Preliminary phytochemical screening of A.*paronychioides* shown both stem and leaves, Aqueous extract present in alkaloids, anthraquinones shown both stem and leaves methanol extract present, absent in aqueous and ethanol extract (Doughari, 2009; Laxmi, 2017).

Preliminary phytochemical surveys and the knowledge of the chemical constituents of plants are desirable to understand herbal drugs and their preparations. Therefore, the phytochemical investigation of *A. Paronychioides* leaves and stem in the present study reveals the presence of various potential phytochemical constituents which may be useful for pharmaceutical industries and could be used as an effective nutraceuticals. The presence of these

Table1. Preliminary Phytochemical Screening of *Alternantheraparonychioides*A.ST.HIL. Leaves

Sl. No	Test	Solvents		
		Aqueous	Ethanol	Methanol
1	Carbohydrates	++	+	++
2	Saponins	+	+	+
3	Tannins	+	+	+
4	Proteins	-	-	-
5	Alkaloids	+	-	-
6	Flavonoids	-	-	-
7	Glycoside	+++	+++	+++
8	Anthraquinones	-	-	+
9	Reducing sugar	++	+	+

Note:-(- = Absent, + = Present,), (+ = Minimum,++ = Moderate,+++ = Maximum)

Table 2. Preliminary Phytochemical Screening of *lternanthera paronychioides* A.ST.HIL.stem

Sl. No	Test	Solvents		
		Aqueous	Ethanol	Methanol
1	Carbohydrates	++	++	++
2	Saponins	+	+	+
3	Tannins	+	+	+
4	Proteins	-	-	-
5	Alkaloids	+	-	-
6	Flavonoids	-	-	-
7	Glycoside	+++	+++	+++
8	Anthraquinones	-	-	+
9	Reducing sugar	+	++	+

Note: - (- = Absent, + = Present,), (+ = Minimum, ++ = Moderate, +++ = Maximum)

phytochemicals is an indicator, that the plant can be a potential source of precursors in the development of synthetic drugs. Antibiotics are one of the most important weapons that fight against bacterial and fungal infections. The human life has been benefited since the introduction of antimicrobial agents.

Antimicrobial Activity

The antibacterial activity of the aqueous extract of *A. paronychioides,* the highest inhibitory effect to the extract was observed on *Staphylococcus aureus* (Figure 3 and Table 3), leaf extract with a zone of inhibition of 40 mm while *Bacillus subtilis* (Figure 6 and Table 6) leaves ethanol and methanol extract was the least inhibited with a zone of inhibition of ethanol 40 mm, methanol 30-50mm. Antibacterial activity of the Aqueous extract of *A. paronychioides* the highest inhibitory effect to extract was observed on *Salmonella typhi* (Figure 9 and Table 9), stem extract with a zone of inhibition 50mm while *Bacillus subtilis* (Figure 10 and Table 10). Stem

Table 3. Antibacterial activity of *A. paronychioides* leaves of different solvent extract against *Staphylococcus aureus.*

Sl. No	Extract Used	Zone of Inhibition (in cm)/Concentration in µg/ml					
		control	10	20	30	40	50
1	Aqueous	10.16±1.25	16.40±0.52	12.26±0.46	37.86±0.32	52.66±5.03	46.66±2.08
2	Ethanol	32.26±0.30	22.1±0.36	26±2	42.23±0.68	29.8±0.72	30±1
3	Methanol	40±1	5.96±0.85	13.5±0.5	27.16±1.60	29.3±0.51	24.8±0.81

Note: Values are represented as mean diameter of zone of inhibition in triplicates ± standard deviation (P<0.001).

Table 4. Antibacterial activity of *A. paronychioides* leaves of different solvent extract against *Escherichia coli*

Sl. No	Extract Used	Zone of Inhibition (in cm)/Concentration in µg/ml					
		control	10	20	30	40	50
1	Aqueous	39.93±0.6	2.66±0.32	12.06±0.20	17.96±0.05	26±0.2	32.3±0.60
2	Ethanol	0.00	8.75±0.17	10.4±0.78	4.03±0.06	12±0	24.8±0.55
3	Methanol	56.6±0.3	14.8±2.17	17.96±0.05	20.13±0.32	12±0	27.13±0.23

Note: Values are represented as mean diameter of zone of inhibition in triplicates ± standard deviation (P<0.001).

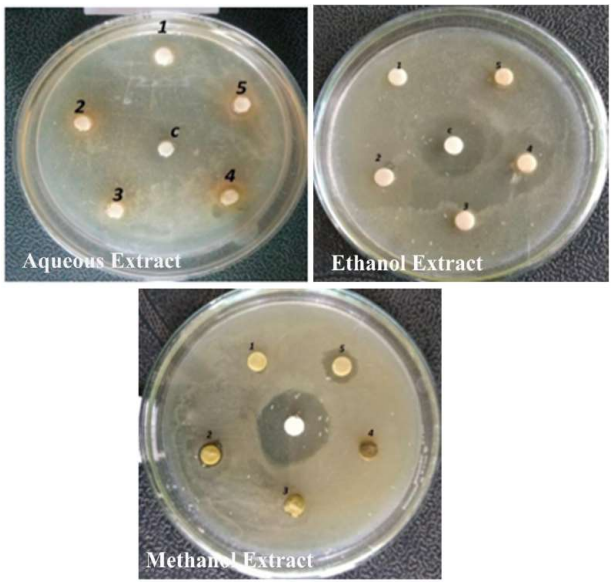

Figure 3. Antibacterial activity of *Alternanthera paronychioides* A.St.-Hil. leaves against *Staphylococcus aureus*

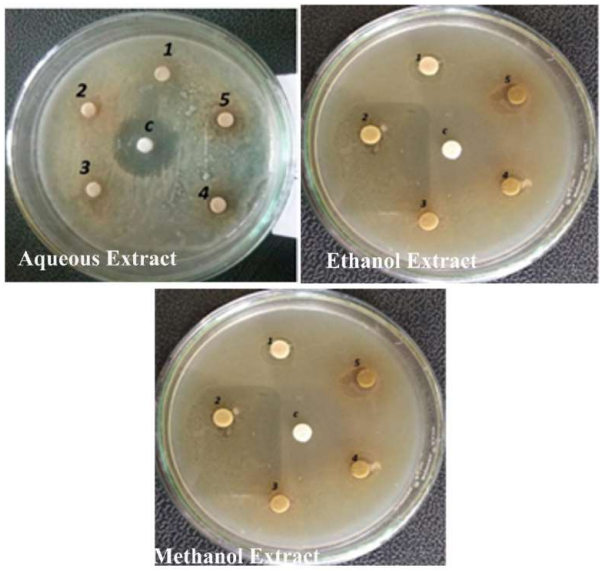

Figure 4. Antibacterial activity of *Alternanthera paronychioides* A.St.-Hil. leaves against *Escherichia coli*

ethanolic extract was least inhibited with a zone of inhibition of 30mm Plants of the genus *Alternanthera* are thought to possess antimicrobial and antiviral properties Sunil et al., 2008, reported that the wound healing property, nosocomial infection, food borne illness (Cheikna, 2011).

A. paronychioide might be due to the inhibitory effect of the plant extract observed in *Staphylococcus aureus* and *Escherichia coli, Salmonella typhi, Bacillus subtilis* and were not susceptible to the extract. This might be due to the inability of the active components in the plant extract to inhibit these organisms. Srilanka used for tradition medicinal plant, also use it for the treatment of biliousness, dyspepsia and sluggish liver. Alternanthera paronychioides is used in local medicine to treat hepatitis, tight chest, bronchitis, asthma and other lung troubles. *A.paronychioides* protects pancreatic β cells from glucotoxicity by its antioxidant, antiapoptotic and insulin secretagogue actions (Kumari, 2016).

Conclusion

This study showed that *A. Paronychioides* has antibacterial

Table 5. Antibacterial activity of *A. paronychioides* leaves ofdifferent solvent extract against *Salmonella typhi*

Sl. No	Extract Used	Zone of Inhibition (in cm)/Concentration in µg/ml					
		control	10	20	30	40	50
1	Aqueous	50.16±0.15	18±0	19.63±0.55	10.06±0.20	28±0	40.16±0.76
2	Ethanol	53.66±0.57	23.93±0.05	18±0	22.1±0.26	24.13±0.321	30.32±0.57
3	Methanol	22.1±0.20	34.13±0.15	15.96±0.05	20.13±0.41	12.04±0.16	8.13±0.83

Note: Values are represented as mean diameter of zone of inhibition in triplicates ± standard deviation (P<0.001).

Table 6. Antibacterial activity of *A. paronychioides* leaves of different solvent extract against *Bacillus substilis*

Sl. No	Extract Used	Zone of Inhibition (in cm)/Concentration in µg/ml					
		control	10	20	30	40	50
1	Aqueous	38.13±0.23	24±0	28.06±0.20	20±0	26.16±0.65	34.13±0.32
2	Ethanol	0.0	24±0	6.1±0.26	2.03±0.25	0.0	8±0
3	Methanol	71.16±0.15	6.06±0.20	4.13±0.70	0.0	2.13±0.70	0.0

Note: Values are represented as mean diameter of zone of inhibition in triplicates ± standard deviation (P<0.001).

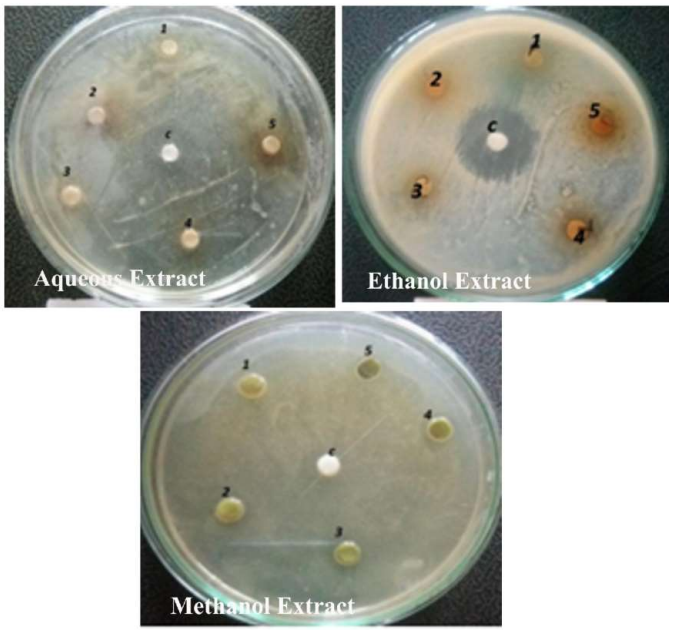

Figure 5. Antibacterial activity of *Alternanthera paronychioides* A.St.-Hil.leaves against *Salmonella typhi*

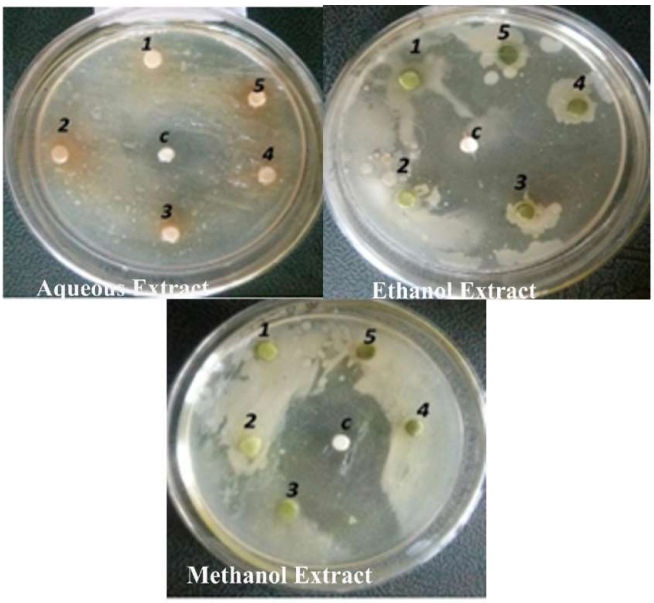

Figure 6. Antibacterial activity of *Alternanthera paronychioides* A.St.-Hil.leaves against *Bacillus subtilis*

Table 7. Antibacterial activity of *A. paronychioides*stem of different solvent extract against *Staphylococcus aureus*

Sl. No	Extract Used	Zone of Inhibition (in cm)/Concentration in µg/ml					
		control	10	20	30	40	50
1	Aqueous	61±3.60	16.13±0.32	6±0	9±1	19.96±0.05	32.06±0.20
2	Ethanol	50±0.7	11.46±0.50	22.1±0.26	2±0	22.6±0.55	32.6±0.52
3	Methanol	39.93±0.50	6±0	10.4±0.26	15.93±0.11	16.53±0.50	20.26±0.30

Note: Values are represented as mean diameter of zone of inhibition in triplicates ± standard deviation (P<0.001).

Table 8. Antibacterial activity of *A. paronychioides*stem of different solvent extract against *Escherichia coli*

Sl. No	Extract Used	Zone of Inhibition (in cm)/Concentration in µg/ml					
		control	10	20	30	40	50
1	Aqueous	59.76±0.68	23.93±0.11	19.96±0.05	17.93±0.05	29.86±0.15	8.23±0.15
2	Ethanol	27.93±0.40	12.36±0.40	3.1±0.1	20.3±0.60	32±0	43.06±0.40
3	Methanol	0.00	37.93±0.05	20±1	14.8±0.1	9.9±0.1	42±0

Note: Values are represented as mean diameter of zone of inhibition in triplicates ± standard deviation (P<0.001).

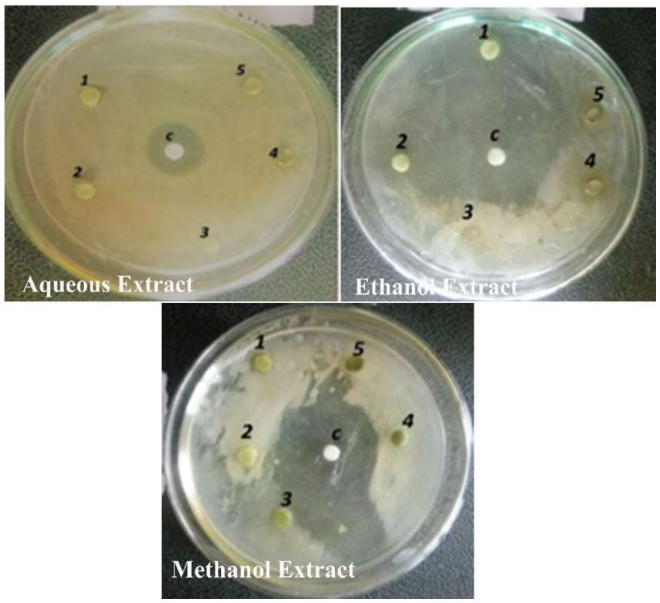

Figure 7. Antibacterial activity of *Alternanthera paronychioides*A.ST.-HIL. Stem against *Staphylococcus aureus*

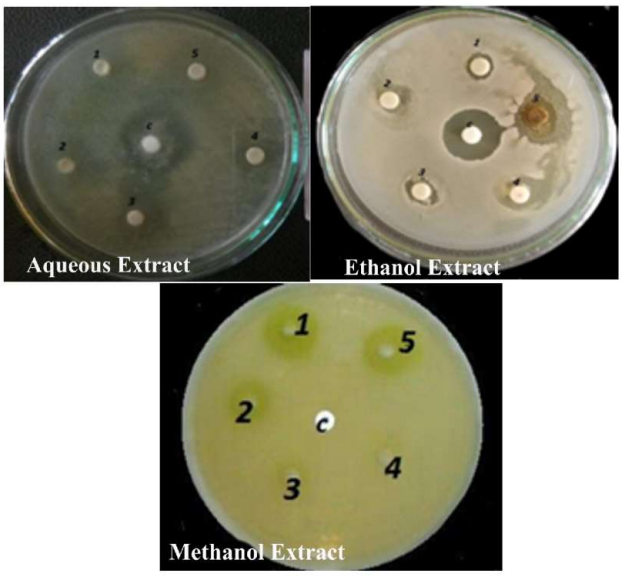

Figure 8. Antibacterial activity of *Alternanthera paronychioides*A.ST.-HIL. Stem against *Escherichia* ***coli.***

activity against, *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi* and *Bacillus subtilis* as verified by the *in vitro* experiments. The present study establishment of *A. Paronychioides* from leaf and stem plant. This is the first report on phytochemical analysis and antimicrobial activity. This is an indication that *A. Paronychioides* can be possibly used for the treatment of wound and antibacterial activity of aqueous extract of *A. Paronychioides* showed broad inhibitory effects on the test isolates. Further purification may enhance greater antibacterial potency. This work has however not included

Table 9. Antibacterial activity of *A. paronychioides* stem of different solvent extract against *Salmonella typhii*

Sl. No	Extract Used	Zone of Inhibition (in cm)/Concentration in µg/ml					
		control	10	20	30	40	50
1	Aqueous	38.56±0.35	20.03±0.55	32.13±0.23	35.96±0.05	35.96±0.05	50.13±0.32
2	Ethanol	52.2±0.52	20.03±0.55	30.93±0.35	26.3±0.51	28.06±0.20	30.16±0.20
3	Methanol	26±0	9.93±0.05	14±0	26.3±0.51	29.96±0.05	7.96±0.05

Note: Values are represented as mean diameter of zone of inhibition in triplicates ± standard deviation (P<0.001).

Table 10. Antibacterial activity of *A. paronychioides* stem of different solvent extract against *Bacillus substilis*

Sl. No	Extract Used	Zone of Inhibition (in cm)/Concentration in µg/ml					
		control	10	20	30	40	50
1	Aqueous	79.9±0.05	18.06±0.20	22.1±0.17	3.96±0.05	10.03±0.15	13.13±0.70
2	Ethanol	31.16±0.37	12.16±0.37	18.23±0.25	0.0	15.96±0.05	9.96±0.05
3	Methanol	74.66±5.03	24.96±0.057	3.5±0	25.96±0.05	29.93±0.11	30.1±0.36

Note: Values are represented as mean diameter of zone of inhibition in triplicates ± standard deviation (P<0.001).

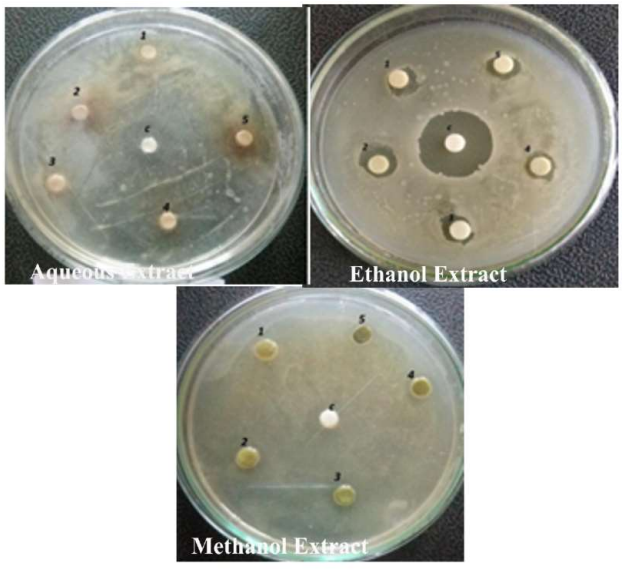

Figure 9. Antibacterial activity of *Alternanthera paronychioides* A.ST.-HIL. Stem against *Salmonella typhii*

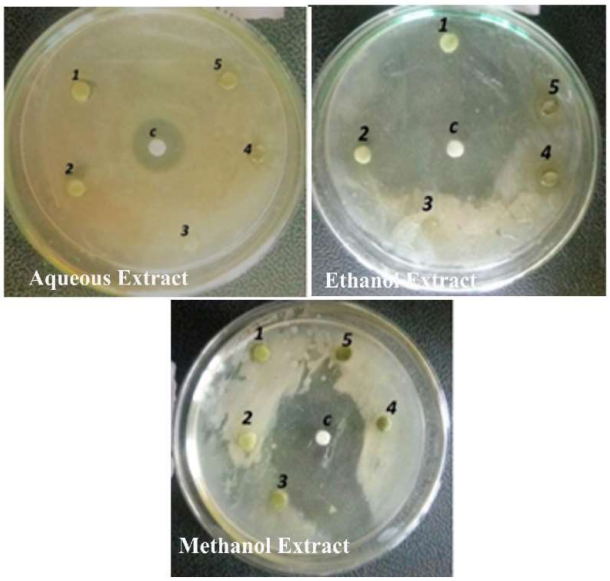

Figure 10. Antibacterial activity of *Alternanthera paronychioides* A.ST.-HIL. Stem against *Bacillus substilis*

the toxicological analysis for more antibacterial effectively as in the case of commercial antibiotics, and more research should be conducted on other medicinal plants that can act synergistically with *A.paronychioides*. Both the plants showed positive results of different secondary metabolites such as, tannins, saponins, glycosides are of medicinal importance and carbohydrates, Reducing sugar are rich source of nutritional value.Further, *A. Paronychioides* seems to be held great potential for in depth investigation for various biological activities and the obtained through this work may be useful in developing new formulation with more therapeutic value. So the plant extract could be used as drugs for various ailments, which can be studied in future studies.

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Conflict of interest statement

We declare that no conflict of interest.

References

Ahmad I, Beg AZ. 2001. Antimicrobial and phytochemical studies on 45 Indian medicinal plants against multi-drug resistant human pathogens. Journal of Ethnopharmacology, 74:113-123.

Cheikna Z, Savadogo A, Somda M, Koudou J. 2011. In vitro evaluation of the antimicrobial and antioxidant properties of extracts from whole plant of *Alternanthera pungens* H.B. & K. and leaves of Combretum sericeum G. Don. International Journal of Phytomedicine, 3:182-191.

Doughari JH, Human IS, Bennade S, Ndakidemi PA. 2009. Phytochemicals as chemotherapeutic agents and antioxidants. Possible solution to the control of antibiotic resistant verocytotoxins producing bacteria. Journal of Medicinal Plants Research, 3 (11):839-848.

Keener D, Diamond A, Davenport L, Davison P, Ginzbarg S, Hansen C, Major C, Spaulding D, Triplett J, Woods M. 2021. Alabama Plant Atlas, 439

Kumari, Krishnan V. 2016. Antimicrobial Activity of Alternanthera Sessilis (L) R. BR. Ex. DC and Alternanthera Philoxeroides (Mart). Griseb. World Journal of Research and Review, 3(3):78-81.

Lalitha Sree T, Vijayalakshmi K. 2016. Phytochemical screening and quantitative analysis of bioactive components in various extracts of *Alternanthera sessilislinn* Leaves. International Journal of Chemistry and Pharmaceutical Sciences, 42-246.

Laxmi S, Zarafsha A. 2017. A Review on *Alternanthera Sessilis*. Indo American Journal of Pharmaceutical Sciences, 4(9):2845-2852.

Marcos j, Salvadorl, Paulo S, Pereira, Suzelei, França, Regina C, Candidoi. 2004. Comparative study of antibacterial and antifugal activity of callus Culture and adult plants extracts from *Alternanthera maritime* (amaranthaceae). Brazilian Journal of Microbiology, 131-136.

Niranjan MH, Prabhurajeshwar. 2020. "Phytochemicals Analysis and Antimicrobial activity of leaf and stem of Ipomoea staphylina Roem. &Schult". International Journal of Research in Pharmaceutical Sciences, vol 11(3).

Niranjan MH, Prabhurajeshwar. 2020. Phytochemical Analysis and Antimicrobial Activity of Leaf and Stem Extracts of Priva cordifolia (L.f.) Druce". European Journal of Medicinal Plants, 31(7):42-53.

Ramamurthy V, Maria Rajeshwari D, Gowri R, Vadivazhagi MK, Jayanthi G, Raveendran S. 2013. Study of the phytochemical analysis and Antimicrobial activity of *dodonaea viscose.* International Journal of Pure and Applied Zoology, 1(2):178-184.

Sukanya S, Sudisha J, Hariprasad P, Niranjana S, Prakash H, Fathima S. 2009. Antimicrobial activity of leaf extracts of Indian medicinal plants against clinical and phytopathogenic bacteria. African Journal of Biotechnology, 8 (23):6677-6682.

Sunil S, Jalalpure, Agrawal N, Patil MB, Chimkode R, Tripathi A. 2008. Antimicrobial and wound healing activities of leaves of *Alternanthera sessilis*linn. International Journal of Green Pharmacy, 141-144.

Tiwari P, Kumar H, Kaur M, Kaur G. 2011. Phytochemicals screening and Extraction: A Review. International Pharmaceutical Science, (1):98-106.

Vimalanalinakumari E, Krishnan V. 2016. Qualitative and quantitative estimation of phytochemicals of *Alternanthera sessilis* (l) r. Br. Ex. Dc and *Alternanthera Philoxeroides* (mart). Griseb. International Journal of Botany and Research (IJBR) Vol. 6(4):29-34.

World Health Organization. 2005. WHO Policy Perspectives on Medicines- containing antimicrobial resistance, WHO/PSM/2005.1, Geneva