ejpmr, 2018,5(1), 235-242

SJIF Impact Factor 4.161

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

QUANTITATIVE ANALYSIS OF PHYTOCHEMICALS AND ANTIMICROBIAL ACTIVITY OF LEAVES AND FRUIT EXTRACTS OF *SOLANUM TRILOBATUM* L.

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Article Received on 26/10/2017 **Article Revised on 16/11/2017** **Article Accepted on 07/12/2017**

ABSTARCT

In the present study, quantitative analysis of phytochemicals and *in vitro* antimicrobial potentials of different solvent extracts of *Solanum trilobatum* were demonstrated. The phytochemical analysis revealed the presence of alkaloids, carbohydrate, cardiac glycosides, flavonoids, saponins, polyphenols, tannins, terpenoids with absence of anthraquinones and steroids. The results validate the traditional uses of *S. trilobatum* in treatment of various diseases. Five gram-positive (*Bacillus cereus*, *Bacillus subtilis*, *Streptococcus cremoris*, *Streptococcus fecalis*, *Staphylococcus aureus*) and seven gram-negative (*Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Salmonella paratyphi*, *Shigella boydi*, *Shigella dysentriae*) bacterial strains were tested. The ethanol extracts of leaves have been showed encouraging results. The maximum inhibition were recorded 38.1 mm in *Bacillus cereus* at 250 µl concentration followed by *S. aureus* (32.3 mm), *E. coli* (30.8 mm), *S. cremoris* (29.6 mm), *P. aeruginosa* (29.3 mm), *Klebsiella pneumonia* (26.2 mm), *Shigella dysentriae* (25.4 mm), *Proteus vulgaris* (24.6 mm), *Streptococcus fecalis* (24.3 mm) and *Shigella boydi* (24.3 mm), *B. subtilis* (19.3 mm) and least inhibition was observed in *S. paratyphi* (18.2 mm). When compare to leaves, fruit extracts showed higher antibacterial activity. Ethanol extracts of fruits showed maximum inhibition 40.2 mm in *Bacillus cereus* at 250 µl concentration followed by *S. aureus* (35.2 mm), *E. coli* (33.6 mm), *P. aeruginosa* (31.0 mm), *S. cremoris* (30.2 mm), *Shigella dysentriae* (28.6 mm), *Proteus vulgaris* (27.4 mm), *Klebsiella pneumonia* (27.2 mm), *Shigella boydi* (25.4 mm), *Streptococcus fecalis* (25.2 mm) and, *B. subtilis* (20.3 mm) and least inhibition was observed in *S. paratyphi* (19.1 mm). Moderate activity was observed in chloroform extract. Minimum activity was observed in hexane extract at different concentration tested. Compared to synthetic antibiotic Ampicillin (50 mg), solvent extracts showed significant antibacterial activity. The present findings support to the traditional knowledge of the medicinal plants to the local users and plants used as therapeutic agents for treat several diseases caused by the human pathogenic bacterial populations. This study confirms significant antibacterial activity of *Solanum trilobatum*.

KEYWORDS: Medicinal Plants, *Solanum trilobatum*, Bioactive compounds, Antimicrobial activity.

INTRODUCTION

Plants are playing an important role in the health of millions of people's life in India. Ethnobotanical and traditional uses of natural compounds, especially of plant origin received much attention in recent years as they are well tested for their efficacy and general believed to be safe for human use. Traditionally, plants are used in the treatment of many infections and systemic disorders. More than hundreds of chemical compounds are derived from plants and used as therapeutic agents to treat various disorders (Oliver, 2013). The plants which have medicinal values due to their health-enhancing and therapeutic properties are referred as herbs (Lahlou, 2013; Parasuraman *et al*., 2014). Various pharmacologically active compounds which are derived from different parts of plants directly or indirectly can act as life-saving drugs (Mickymaray *et al.*, 2016). Plant based antimicrobials represent a vast untapped source for medicines and further exploration of plant antimicrobials need to occur. Human infections particularly those involving microorganisms ie. bacteria, fungi, viruses they cause many diseases. The frequency of life threatening infections, caused by pathogenic microorganisms has increased worldwide and is becoming an important cause of morbidity and mortality in immune compromised patients in developing countries (Al-bari *et al*., 2006). Phytomedicines have been used to treat or prevent various disorders (Steenkamp, 2003).

Traditionally, plants are used in the treatment of many infections and systemic disorders. Screening of plants for antimicrobial agents has gained greater attention recently. Medicinal plants are used by 80% of the world population as the only available medicines especially in

developing countries (Hasim *et al*., 2010). Medicinal plants from a large group of economically important plants that provide the basic raw materials for indigenous pharmaceuticals. Medicinal plants are very important source of life saving drugs for the ever increasing world population. The developing countries greatly depend on plants, where a major role in health care is played by traditional medicine (Zakaria, 1991).

In the modern world, multiple drug resistance has developed against many microbial infections due to the indiscriminate use of commercial antimicrobial drugs commonly used in the treatment of infectious disease (Ahmed *et al*., 1998). In addition to this problem, antibiotics are sometimes associated with adverse effects on the host including hypersensitivity, immune-suppression and allergic reactions (Cunha, 2001). The beneficial medicinal effects of plant materials typically result from the combinations of secondary products present in the plant. In plants, these compounds are mostly secondary metabolites such as alkaloids, steroids, tannins, phenolic compounds, flavonoids, steroids, resins, fatty acids and gums which are capable of producing definite physiological action on body (Wang, 2002). It also found to possess antibacterial, antifungal, antioxidant and anti-tumour properties (Jawahar *et al*., 2004; Sugnanam *et al*., 2015).

Solanum trilobatum L., (Solanaceae) is a rare, perennial, medicinal herb available in southern India. The genus *Solanum* is comprised of about 1500 species and well represented all over the world. It is rich in alkaloids which are distributed in all parts of the plant (Doss and Dhanabalan, 2008; Nirmala Devi and Ramachandramurthy, 2014). It has been widely used as an expectorant and in the treatment of respiratory diseases including bronchial asthma, febrile infections, and tuberculosis (Govindan *et al*., 2004). The leaves contain rich amount of calcium, iron, phosphorus, carbohydrates, protein, fat, crude fibre and minerals. This plant is used as medicine for asthma, respiratory disorders, rheumatism and in reducing blood glucose level. It also possesses antibacterial, antifungal, antioxidant and antitumouours properties (Govindan *et al*., 2004). It is also possess antibacterial, antifungal, antimitotic and antitumourous (Purushothaman *et al*., 1969; Sai Durga Prasad *et al*., 2015). The methanolic extract of *S. trilobatum* has been shown to possess antioxidant activity (Shahjahan *et al*., 2005) and hepatoprotective activity (Shahjahan *et al*., 2004). The constituents of this plant include sobatum, solamarine, solanine, solasodine, glycoalkaloid, diosogenin and tomatidine (Guilietti, 1991). Sobatum, the partially purified petroleum ether extract of *S. trilobatum* has been reported to be very effective in protecting UV induced damage (Mohanan and Devi, 1998), radiation-induced toxicity and inducing tumor reduction in mice (Mohanan and Devi, 1996). Solasodine and sobatum isolated from *S. trilobatum* plant has been shown to possess anti-inflammatory activity (Emmanuel *et al*., 2006). Many pharmacological activities are found in *S. trilobatum* like hepatoprotective activity, antimicrobial activity, larvicidal activity, antidiabetic activity, cytotoxic activity and anticancer activity (Priya and Chellaram, 2014). Various chemical compounds are identified in *Solanum* species they are flavanoides, sterols, saponins alkaloids, phenolics, and their glycosides. The secondary compound of alkaloids from soladunalinidine and tomatidine were isolated from leaf and stem of *Solanum* species (Amir and Kumar, 2004). This plant also showed significant hepatoprotective activity against carbon tetrachloride induced hepatic damage in rats, antimicrobial activity against *Escherichia coli* and, *Staphylococcus aureus* and antifungal activity against *Aspergillus flavus* and *A. niger* (Nagarajan *et al*., 2009). The phytochemical and biological importance of the different parts of *S. trilobatum* was not explored completely. Hence, the objective of the present investigation was aimed at evaluation of phytochemical constituents of the leaves, and fruits and *in vitro* antimicrobial activity of valuable medicinal plant *Solanum trilobatum*.

MATERIALS AND METHODS

Collection of Plant materials: The plant samples such as leaves and fruits of *Solanum trilobatum* were collected from Vathal hills of Dharmapuri district in Tamilnadu, India during ethnobotanical surveys in 2014 to 2016. Specimen was labeled, numbered, annotated with the date of collection, the locality and their medicinal uses. The voucher specimens were then identified, and deposited deposited in the herbarium of PG and Research Department of Botany, Government Arts College, Dharmapuri for the future reference. After authentification leaves and fruits were collected in bulk, washed, shade dried and extracted with different solvents such as hexane, chloroform and ethanol for 48 hrs in a Soxhlet assembly.

Preparation of extracts: Fresh leaves and fruits were washed thoroughly under running tap water followed by sterile distilled water and dried under shade. They were ground into coarse powder by using mechanical pulveriser. All the samples, about 100 g of the powder were repeatedly extracted with hexane, chloroform and ethanol in a 500 mL round bottom flask with 250 mL solvent separately. The reflux time for each solvent was 25 cycles for complete extraction using soxhlet apparatus (Harbone, 1998). The filtrate was collected and concentrated by using rotary evaporator under controlled condition of temperature and pressure. The extracts were concentrated to dryness to yield crude residue. These residues were stored at -20°C, used for quantative phytochemical screening of secondary metabolites and *in vitro* antibacterial assay.

Phytochemical analysis: Phytochemical screening were performed to assess the qualitative phytochemical composition of different samples of crude extracts using commonly employed precipitation and coloration

reactions to identify the major secondary metabolites like alkaloids, glycosides, steroids, tannins and terpenoids. The hexane, chloroform and ethanol extracts of *S. trilobatum* were screened for the presence of secondary metabolites using the standard procedures (Trease and Evans, 1989). The observations were recorded for alkaloids by Mayer's test (Raaman, 2008), for glycosides by Biuret and Legal tests, for steroids using Salkowski test (Longanga *et al*., 2000), for tannins using ferric chloride test (Martin and Martin, 1982) and for terpenoids using Salkowski test.

Alkaloids test: To 5 g each of the leaves and fruits extracts and 5 ml of honey was stirred with 5 ml of 1% aqueous hydrochloric acid on a steam bath. One ml of the filtrate was treated with few drops of Draggendoff's reagent. Blue black turbidity serves as preliminary evidence of alkaloids.

Glycosides (keller-killiani test): To 5 g of each of the leaves and fruits extracts and 5 ml of honey was dissolved in 2 ml glacial acetic acid containing a drop of ferric chloride solution. This was underplayed with 1 ml concentrated sulphuric acid. A brown ring of the interface indicates a deoxy-sugar characteristic of cardenolides. A violet ring may appear below the brown ring, while in the acetic acid layer, a green ring may form just gradually spread throughout this layer.

Steriods test: To 2 ml of acidic anhydride was added to 0.5 g of leaves and fruits extracts and 2 ml of sulphuric acid was added by the sides of the test tube and observed the colour change from violet or blue-green.

Tannins test: To 5 g each of the extracts and 5 ml of honey was stirred with 100 ml distilled water and filtered. Ferric chloride reagent was added to the filtrate. A blueblack or blue Green precipitate determines the presence of Tannins.

Terpenoids (Salkowski test): To 0.5 g of the extract, 2 ml of chloroform was added: Concentrated sulphuric acid (3 ml) was carefully added to form a layer. A reddish brown coloration of the interface indicates the presence ofterpenoid.

Microorganisms used in this study: Bacteria causing infectious diseases both in animals and human were used in the present study. They were gram positive bacteria viz. *Bacillus cereus*, *Bacillus subtilis*, *Streptococcus cremoris*, *Streptococcus fecalis*, *Staphylococcus aureus* and gram negative bacteria viz., *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Salmonella paratyphi*, *Shigella boydi* and *Shigella dysentriae*. All the bacterial strains were obtained from the Government General Hospital, Dharmapuri. The cultures were maintained in nutrient broth in the laboratory of PG and Research department of Botany, Government Arts College, Dharmapuri, Tamil nadu, India. They were cultured in nutrient broth for 24 hours and the fresh inoculums were taken for the test.

Culture media and inoculums

Muller Hinton (MH) media (Hi-media Pvt. Ltd; Bombay, India) was used for growth of bacteria.

The inoculum for bacteria was prepared by transferring a large number of bacteria from fresh culture plates to tube containing 10mL of liquid media (DIFCO, Bacto: dehydrated nutrient broth) and incubating over night at 37°C. The tubes were shaken occasionally to aerate and promote growth.

Antibacterial screening: The agar well diffusion method (Perez *et al*., 1990; Olurinola, 1996) was employed for the determination of antimicrobial activity of the extracts. The petriplates containing 20 ml of Muller Hinton Agar medium (Himedia) were seeded with 24 h culture of the microorganisms. Sterilized cotton swabs were dipped in the bacterial culture in nutrient broth and then swabbed on the agar plates. Wells of equal size were cut with proper gaps in the medium and the plant extracts were added into it. The wells (6 mm in diameter) were cut from the agar and the extract solutions in different concentration (50 µl, 100 µl, 150 µl, 200 µl and 250 µl) were delivered into them. The control well of Ampicillin was used at 50 µl concentration. The plates were incubated at 37°C for 24 h. Clear inhibition zones around the wells indicated the presence of antibacterial activity. After incubation time, the zone of inhibition was measured precisely in millimeters (mm). The same procedure was followed for standard antibiotics ampicillin (50 µl) to compare the efficacy of extracts against test organisms. Each experiment was repeated three times, and the average values were calculated. The ampicillin stock solution was prepared at the concentration of 1mg/mL. The controls were prepared using the same solvents employed to dissolve the extracts. The inoculated plates with the test and standard discs on them were incubated at 37ºC for 24 h.

RESULTS

In the present study, to evaluate the quantitative analysis of phytochemical of hexane, chloroform and ethanol extracts of *Solanum trilobatum* leaves and fruits samples are presented in Table 1. All the samples of leaves and fruits showed the abundant occurrence of phytochemicals in varying concentrations. The ethanol extract showed the maximum presence of glycosides in leaves and fruits (65.32%, 84.52%) and alkaloids (58.63%, 76.21%). In chloroform extract showed the maximum presence of steroids in leaves and fruits (91.24%, 95.68%) respectively. In hexane extracts anthroquinones (79.21%, 82.34%), tannins (80.24%, 77.54%), saponins (73.23%, 77.10%) and terpenoids (62.17%, 66.25%) respectively. In hexane extract, leaves and fruit samples showed high content of tannins, followed by terpenoids, saponins and anthroquinones and

low level alkaloids and glycosides. However, the fruit extracts yields more bioactive compounds than leaf extracts in all three solvents such as hexane, chloroform and ethanol.

In vitro antibacterial activity results of leaves and fruit extracts of *S. trilobatum* showed excellent effect against the five gram positive and seven gram negative bacteria. The result of leaves extracts are presented in Table 2. The maximum zone of inhibition was observed on *B. cereus* (38.1 mm) in ethanol 250 µl concentration followed by *S. aureus* (32.3 mm), *E. coli* (30.8 mm), *S. cremoris* (29.6 mm), *P. aeruginosa* (29.3 mm), *K. pneumonia* (26.2 mm), *S. dysentriae* (25.4 mm), *P. vulgaris* (24.6 mm), *S. fecalis* (24.3 mm), *S. boydi* (24.3 mm), and *B. subtilis* (19.3 mm), and minimum zone of inhibition observed on *S. paratyphi* (27.6 mm). The result of fruit extracts were presented in Table 3. The maximum zone of inhibition was observed on *B. cereus* (40.2 mm) in ethanol 250 µl concentration followed by *S. aureus* (35.2 mm), *E. coli* (33.6 mm), *P. aeruginosa* (31.0 mm), *S. cremoris* (30.2 mm), *S. dysentriae* (28.6 mm), *P. vulgaris* (27.4 mm), *K. pneumonia* (27.2 mm), *S. boydi* (25.4 mm), *S. fecalis* (25.2 mm) and *B. subtilis* (20.3 mm), and minimum zone of inhibition observed on *S. paratyphi* (19.1 mm). The positive control, ampicillin (50 µl) had shown zone of inhibition are presented in Table 2 and 3. The *in vitro* antibacterial activity revealed that the ethanol extract had significant activity against all the microorganisms tested, mainly *B. cereus*, *E. coli*, *S. fecalis*, *K. pneumonia*, *S. aureus*, and *P. aeruginosa* (zone of inhibition >30 mm) but inactive in lower concentration (50 µl) on *S. paratyphi*. The chloroform extracts possessed moderate activity against all microorganisms tested, *B. cereus*, *S. fecalis*, *E. coli*, *K. pneumonia S. aureus* and *P. vulgaris* (zone of inhibition >20 mm) but was inactive against *P. aeruginosa P. vulgaris* and *S. typhi*. The hexane extract exhibited only weak activity against *S. typhi*, *P. vulgaris*, *B. subtilis*, *S. aureus*, *S. cremoris* and *P. aeruginosa*. The moderate inhibition activity was observed in antibiotic ampicillin against *B. cereus*, *S. fecalis*, *S. aureus*, *E. coli* and *K. pneumonia* these results showed the similar effect in 100 µl of ethanol extract and 150 µl of chloroform extract.

Table 1: Quantative Phytochemical analysis of different solvent extracts of *Solanum trilobatum* leaves and fruits.

Bioactive compounds	Hexane extract		Chloroform extract		Ethanol extract	
	Leaves	Fruits	Leaves	Fruits	Leaves	Fruits
Alkaloids	23.21 %	43.52 %	34.62 %	69.54 %	58.63 %	76.21 %
Glycosides	12.58 %	25.24 %	28.79 %	49.87 %	65.32 %	84.52 %
Steroids	26.20 %	35.61 %	91.24 %	95.68 %	55.11 %	65.14 %
Tannins	77.54 %	80.24 %	52.18 %	62.57 %	44.52 %	48.22 %
Terpenoids	62.17 %	66.25 %	42.31 %	44.54 %	30.23 %	34.69 %
Saponins	73.23 %	77.10 %	66.55 %	68.24 %	39.74 %	46.27 %
Anthroquinones	79.21 %	82.34 %	28.30 %	33.26 %	20.20 %	29.32 %

Table 2: *In vitro* Antibacterial activity of leaf extracts of *Solanum trilobatum* by well diffusion method.

Bacterial organisms	Amp (50 µl)	Zone of inhibition (mm)														
		Concentrations														
		Hexane extract					Chloroform extract					Ethanol extract				
		50 µl	100 µl	150 µl	200 µl	250 µl	50 µl	100 µl	150 µl	200 µl	250 µl	50 µl	100 µl	150 µl	200 µl	250 µl
B. cereus	27.2	-	-	11.2	15.4	17.8	10.2	12.5	16.8	20.4	28.1	17.8	21.5	26.4	32.6	38.1
B. subtilis	17.3	-	-	10.5	14.6	18.4	-	-	10.1	14.6	18.4	-	-	11.2	15.4	19.3
S. cremoris	20.7	-	-	-	-	10.1	-	10.2	14.6	19.5	24.6	-	11.3	16.4	22.6	29.6
S. fecalis	19.5	-	-	-	-	12.5	-	-	-	13.2	18.5	-	-	12.6	18.4	24.3
S. aureus	24.4	-	-	-	12.7	17.2	-	11.6	17.2	20.5	27.4	12.0	16.8	22.4	27.5	32.3
E. coli	25.1	-	-	13.2	17.5	22.6	-	14.2	17.1	23.3	28.6	12.3	17.0	21.0	26.5	30.8
P. aeruginosa	18.7	-	-	-	-	8.2	-	-	10.5	13.4	17.5	13.7	17.1	20.5	24.6	29.3
K. pneumonia	20.2	-	-	10.5	13.2	18.4	-	-	15.4	19.1	26.5	12.1	15.6	19.4	23.5	26.2
P. vulgaris	15.6	-	-	-	-	10.2	-	-	11.3	15.4	18.5	-	12.0	15.6	22.7	24.6
S. paratyphi	13.1	-	-	-	-	-	-	-	-	11.7	15.6	-	-	12.3	16.7	18.2
S. boydi	17.6	-	-	10.0	14.3	19.1	-	11.2	15.1	19.3	22.4	-	10.2	15.6	20.1	24.3
S. dysentriae	15.2	-	-	-	11.2	14.6	-	-	10.4	16.5	21.0	-	11.2	15.6	19.4	25.4

(Zone of inhibition = values are expressed in millimeter (mm), - = Negative results)

Table 3: *In vitro* Antibacterial activity of fruit extracts of *Solanum trilobatum* by well diffusion method.

Bacterial organisms	Amp (50 µl)	Zone of inhibition (mm)														
		Concentrations														
		Hexane extract					Chloroform extract					Ethanol extract				
		50 µl	100 µl	150 µl	200 µl	250 µl	50 µl	100 µl	150 µl	200 µl	250 µl	50 µl	100 µl	150 µl	200 µl	250 µl
B. cereus	27.2	10.1	12.4	14.6	17.5	20.2	11.5	13.7	18.6	22.5	30.1	18.1	22.4	27.5	33.1	40.2
B. subtilis	17.3	-	10.5	12.6	18.4	22.2	-	11.6	13.8	19.5	23.6	-	11.5	14.0	17.2	20.3
S. cremoris	20.7	-	-	10.3	13.5	16.7	-	10.5	14.1	19.5	25.4	-	11.5	17.0	23.2	30.2
S. fecalis	19.5	-	-	10.4	14.6	18.6	-	-	11.5	13.7	17.8	-	10.2	13.3	17.4	25.2
S. aureus	24.4	-	-	10.8	12.5	16.5	10.6	13.2	17.4	21.7	26.8	14.5	20.2	24.3	28.8	35.2
E. coli	25.1	-	10.6	14.1	18.2	23.2	11.7	14.5	18.3	24.6	28.3	16.1	21.4	25.4	28.5	33.6
P. aeruginosa	18.7	-	-	10.6	13.5	17.9	-	11.4	14.6	18.7	21.4	14.2	18.1	21.5	25.5	31.0
K. pneumonia	20.2	-	10.5	11.4	13.6	19.2	-	10.8	15.2	20.4	25.6	11.2	15.7	20.6	24.5	27.2
P. vulgaris	15.6	-	-	-	11.6	14.5	-	12.5	15.2	18.6	22.2	11.7	14.4	18.2	23.6	27.4
S. paratyphi	13.1	-	-	-	-	10.2	-	-	10.8	13.5	18.4	-	11.6	14.7	17.6	19.1
S. boydi	17.6	-	11.1	14.1	17.6	20.4	10.6	13.7	17.5	20.2	25.5	11.2	14.3	18.6	21.4	25.4
S. dysentriae	15.2	-	-	11.6	14.2	18.0	-	11.2	14.6	19.3	23.1	11.8	15.2	18.9	22.2	28.6

(Zone of inhibition = values are expressed in millimeter (mm), - = Negative results)

DISCUSSION

The present results revealed that the leaves and fruits extracts showed high amount of tannins, terpinoides, saponins and anthroquinones. Plant derived substances have recently become of great interest owing to their versatile applications. Medicinal plants are richest bio resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs (Ncube *et al*., 2008). The phytochemical screening and quantitative estimation of the percentage crude yields of chemical constituents of the plants studied showed that the leaves and roots were rich in alkaloids, phenol and tannins. The presence of phenolic compounds in the plants indicates that these plants may be anti- microbial agent. This agreed with the findings of (Ofokansi *et al*., 2005). Tannins have stringent hasten the healing of wounds and inflamed mucous membranes. Apart from tannin and phenolic compounds, other secondary metabolite constituents of all the five plants detected include the alkaloids, saponin and anthroquinones. Saponin has the property of precipitating and coagulating red blood cells (Sadipo *et al*., 2000). Therefore, the data generated from these experiments have provided the chemical basis for the wide use of this plant as therapeutic agent for treating various ailments.

Solanum trilobatum is traditionally used in the treatment of respiratory illness. The leaves of *S. trilobatum* also contain oladunalinidine, tomatidine, solasodine, betasolamarine, sobatum, solaine and diosogenin (Sahu *et al.*, 2013). Latha and Kannabiran (2006) also studied the antimicrobial activity of the aqueous and organic extract of the leaves, stem, flowers and fruits of *S. trilobatum*. Aqueous extract of leaves of *S. trilobatum* inhibited the microbial growth of *S.aureus*, and *Bacillus subtilis* and *Klebsiella pneumoniae*. Whereas n-butanol extract of leaves of *S. trilobatum* inhibited the microbial growth *S. aureus*, *E. coli* and *K. pneumoniae*. In the present study, ampicillin showed antimicrobial activity against Gram-positive *S. aureus* and gram-negative *E. coli*. The activity against *E. coli* may be due to inhibition of microbial growth in lag phase (Lawrence and Anthony, 2013). The similar findings were obtained by Suganga *et al.*, (2012); Santhi *et al*. (2011) while studying phytochemical and antimicrobial activity from *Nerium oleander*. Methanolic extract of *Nerium Oleander* had the maximum zone of inhibition i. e. 28mm (Jeyachandra *et al.* 2010). None of the crude extracts were able to inhibit the growth of *S typhi.* Hussain and Gorsi (2004) studied that root and leave ethanolic extract of *Nerium oleander* shows effective action against gram +ve and gram –ve bacteria and fungus. According to the Jude (2013) *Nerium Oleander*, *Lippia nodiflora*, *Wattakaka volubilis* and *Weinmanna tinctoria* has possessed the highest zone of inhibition against *E. coli, K. pneumonia, S. typhi, P. vulgaris* and *P. mirabilis*.

The increased frequency of resistance to commonly used antibiotics led to search for newer, effective, cheap and easily affordable drugs in the management of infectious diseases and plants belonging to the *Solanum* genus have been reported to have remarkable pharmacological activity (Mahadev *et al.*, 2014). In the present study, our results clearly envisaged the antibacterial activity of *S. trilobatum* (leaf and fruit). The antibacterial activity of ethanol extracts was more pronounced than the chloroform and hexane extract against the tested organism. The ethanol extract of plant inhibit the growth of bacteria more than chloroform and hexane extracts of plants. This trend to show that their active ingredients of plant parts are better extracted with ethanol than other solvents. Since, ethanol has high polarity; it could dissolve both polar and non-polar compounds in it (Natheer *et al*., 2012).

All the plant extracts showed antibacterial activity against both Gram positive and Gram negative organisms and this was conformity with earlier findings (Pratheeba *et al*., 2013; Abbas *et al*., 2014). Generally, plant extracts are usually more active against Gram positive bacteria than Gram negative bacteria (Basri and Fan, 2005). This may be due to the important characteristic of plant extracts and their compounds is their components is their hydrophobicity, which enable them to partition the lipids of the bacterial cell membrane, disturbing the cell structures and rendering them more permeable. Extensive leakage from bacterial cells or the exits of critical molecules and ions led to death (Rastogi and Mehrotra, 2002; Gosh *et al*., 2008; de Britto *et al*., 2011). In the present study, MIC values of *Solanum trilobatum* leaf and fruit against *Staphylococcus aureus* and *Klebsiella pneumoniae* auspiciously determines that plant parts can be used in treatment of infectious disease (Kunchai and Kitpipit, 2005; Usha *et al*., 2010). A phytochemical compound from plant material is depending on the type of solvent used in the extraction method. The solubility of the active constituents in solution showed some degree of antibacterial activity (Romero *et al*., 2005). It was remarkable that abundance of phytochemicals such as trepenoid, alkaloid, flavonoid, saponin, anthroquinone and tannin in *Solanum trilobatum* constitutes the main antibacterial principle as suggested by many workers (Tambekar and Khante, 2010; Thambiraj and Paulsamy, 2011.

CONCLUSION

In the present study clearly demonstrated that the quantitative phytochemical screening results of *Solanum trilobatum*, leaf and fruit extracts more phytochemicals. Our study indicates that the leaf and fruit extracts has potential antimicrobial activity against some microbial species. So the use of the biologically active compounds from this plant could represent a natural alternative source of antibiotics.

ACKNOWLEDGMENTS

The author is greatly thankful to the Principal and Head of the Department, PG and Research Department of Botany, Government Arts College, Dharmapuri, for providing the laboratory facilities.

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