Antibacterial And Phytochemical Analysis Of Ervatamia Coronaria And Alternanthera Sessilis Against Harmful Human Pathogens

J.Rajaselvam[1], M.R. Basil Rose[2], Jeni Chandar Padua[3]
[1, 2, 3]Dept of Zoology
[1, 2, 3] Holy Cross College (Autonomous), Nagercoil, Kanyakumari District, Tamil Nadu, India

Abstract- *In the present study phytochemical and antibacterial analysis of the aqueous, acetone and methanol extracts of Ervatamia coronaria L. and Alternanthera sessilis were carried out against seven human pathogenic bacteria such as, Pseudomonas aeruginosa, Staphylococcus albus, Proteus mirabilis, Staphylococcus aureus, Proteus vulgaris, Klebsiella pneumonia and Escherichia coli. The aqueous and methanol extract of Ervatamia coronaria L. showed potent activity against Proteus vulgaris, Escherichia coli, Pseudomonas aeruginosa, Staphylococcus albus, Staphylococcus aureus and Klebsiella pneumoniae than the acetone extract. Alternanthera sessilis showed maximum activity against Klebsiella pneumonia and Proteus mirabilis and least activity against S. aureus in methanol extract. Antimicrobial activity was observed to be low in acetone extracts of leaf and no activity was obtained in the aqueous extract of Alternanthera sessilis. Phytochemical screening of the leaf extracts of both the plants revealed the presence of secondary metabolites such as tannins, saponins, alkaloids, flavonoids, steroids, terpenoids and proteins substantiating the high therapeutic effect of the two plants.*

Keywords- Plants, Antimicrobial activity, phytochemicals, human pathogens.

I. INTRODUCTION

Plant based medicines have been a part of traditional healthcare for thousands of years all over the world [1, 2]. India which is a treasure house of more than 7000 medicinal plant species is well known for its age old ayurvedic practices using medicinal plants. Medicinal plants find their application in cosmetic, pharmaceutical, food and agricultural industries. It has been proved that plants contain many biologically active compounds, many of which are known to exhibit antimicrobial and anticancer properties. Hence they are used as antimicrobial drugs in traditional medicine in the form of infusions, extracts, decoctions and powder for treating diseases in humans, plants and animals. World Health Organization reports that more than 80% of the world's population mainly depends on traditional medicine for its primary health care needs [3]. Medicinal plants are used in modern medicine as raw material for some important drugs. But even when antibiotics and synthetic drugs have brought about a revolution in controlling different diseases, they are out of reach to millions of people who live in remote places. In addition, the microbes also develop resistance to antibiotics in due course of time. Hence they are mainly depending on traditional healers who rely on the judicious use of medicinal herbs to cure deadly diseases that have long defied synthetic drugs. Plants are a source of many potent and powerful drugs which are used in various countries [4]. The present investigation on the antimicrobial and phytochemical potential of Ervatamia coronaria and Alternanthera sessilis, was carried out to find the use of these two plants as potent therapeutic agents.

II. MATERIALS AND METHODS

2.1 Preparation of Plant Material

Fresh, disease free, healthy leaves of the two plants, Ervatamia coronaria and Alternanthera sessilis, were collected in the early morning hours (6–8 am). It was washed using tap water, dried at room temperature and used for the preparation of extract. Solvents such as, water, acetone and methanol were used to prepare different extracts. The dried samples were ground to coarse powder and the active compounds were extracted using a Soxhlet apparatus. The extracts obtained were concentrated and stored in refrigerator.

2.2 Microbial Strains used for Antibacterial Assay

The bacteria such as Klebsiella pneumoniae, Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus, Proteus mirabilis, Staphylococcus albus and Proteus vulgaris, used in this investigation, were kind gift from Vivek laboratories, Nagercoil, Kanyakumari District, Tamil Nadu, India.

2.3 Antibacterial Assay

Agar diffusion method was carried out for antibacterial susceptibility test [5]. Bacterial culture of 0.1 ml having 108 CFU was spread on nutrient agar (NA) plate using a sterile swab. Wells of 4 mm diameter and about 2 cm apart were punched off in to medium with sterile cork borer and filled aseptically with 20 µl of leaf extracts. The inoculated plates were incubated at 37 oC for 24 - 28 h. The antibiotic streptomycin was used as standard reference.

2.4 Phytochemical Screening

Phytochemical screening was carried out to determine the presence of tannins, saponins, steroids, flavonoids, terpenoids, alkaloids and proteins [6, 7, 8, 9, 10].

III. RESULTS AND DISCUSSION

3.1. Antibacterial Activity

Aqueous, methanol and acetone extracts of Ervatamia coronaria L. and Alternanthera sessilis showed various degrees of antimicrobial activity against seven selected human pathogenic bacteria such as P. aeruginosa, S. albus, S. aureus, P. mirabilis, P. vulgaris, K. pneumonia and E. coli. The aqueous and methanol extracts of Ervatamia coronaria L showed maximum inhibiting activity against P. vulgaris (13 mm) and E. coli (13 mm). This was followed by P. aeruginosa (12 mm), S. albus (12 mm), S. aureus (12 mm), and K. pneumoniae (12 mm) (Fig. 1-7). In the acetone extract, no antibacterial activity was observed against Pseudomonas aeruginosa, Staphylococcus aureus, Proteus mirabilis and Proteus vulgaris (Table -1, Fig. 8). This could be due to the solubility of the active fragments capable of inhibiting the microbial growth in water and methanol but not in acetone.

The acetone extracts of A. sessilis showed maximum inhibiting activity against K. pneumoniae (8 mm) followed by E. coli (7 mm) and P. vulgaris (7 mm) (Table -2, Fig. 9). The methanol extracts of A. sessilis showed maximum inhibiting activity against K. pneumoniae (11 mm) and P. mirabilis (11 mm) and least activity was observed against S. aureus (7 mm). Aqueous extract of A. sessilis showed no potent antimicrobial activity. Differential microbial inhibition of both the plants in different solvents, reveal that these plants have diverse components with affinity to various solvents, and inhibit the growth of pathogenic microbes.

Fig. 1. Antibacterial activity of Ervatamia coronaria L against P. aeruginosa.

Fig. 2. Antibacterial activity of Ervatamia coronaria L against S.albus.

Fig. 3. Antibacterial activity of Ervatamia coronaria L against P. mirabilis.

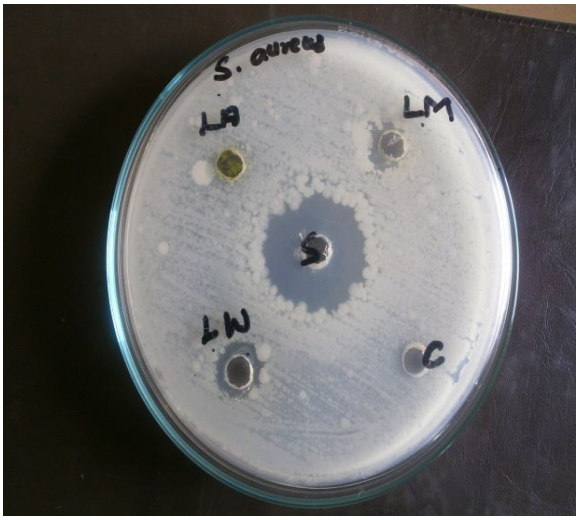

Fig. 4. Antibacterial activity of Ervatamia coronaria L against S. aureus.

Fig. 5. Antibacterial activity of Ervatamia coronaria L against P. vulgaris.

Fig. 6. Antibacterial activity of Ervatamia coronaria L against K. pneumonia.

Fig. 7. Antibacterial activity of Ervatamia coronaria L against E. coli.

Table 1. Antibacterial activity of the aqueous, acetone and methanol extract of the leaf of Ervatamia coronaria L.

SL. No	Species of Bacteria	Zone of Inhibition (mm)			
		I	II	III	IV
1	*P.aeruginosa*	-	12	10	24
2	*S.albus*	-	10	12	30
3	*P. mirabilis*	-	8	-	20
4	*S. aureus*	-	8	12	20
5	*P. vulgaris*	-	10	13	17
6	*K.pneumoniae*	8	12	11	19
7	*E.coli*	8	13	-	19

I – Acetone, II – Methanol, III – Water,
IV - Standard Streptomycin

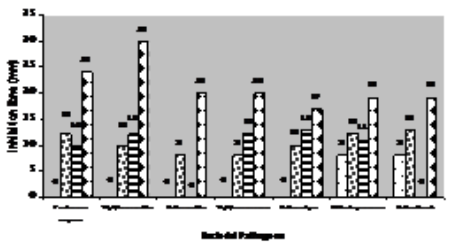

Fig 8. Antibacterial Activity of the leaf of Ervatamia coronaria

Table 2. Antibacterial activity of aqueous, acetone and methanol extract of the leaf of Alternanthera sessilis. against seven human pathogens as tested by agar well diffusion assay.

SL. No	Species of Bacteria	Zone of Inhibition (mm)			
		I	II	III	IV
1	*P.aeruginosa*	-	-	-	24
2	*S.albus*	-	8		30
3	*P. mirabilis*	-	11	-	20
4	*S. aureus*	-	7	-	20
5	*P. vulgaris*	7	8	-	17
6	*K.pneumoniae*	8	11	-	19
7	*E.coli*	7	10	-	19

I – Acetone, II – Methanol, III – Water,
IV - Standard Streptomycin

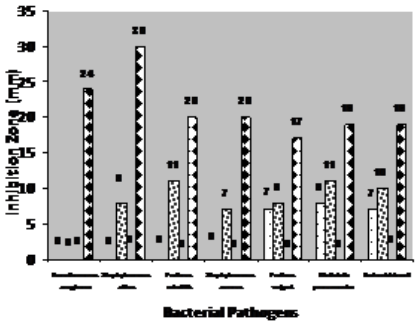

Fig 9. Antibacterial Activity of Alternanthera sessilis

Table 3. Preliminary phytochemical analysis of Ervatamia coronaria leaf extracts

Phytoconstituents	Acetone	Methanol	Water
Alkaloids	+	+	+
Terpenoids	-	+	+
Flavonoids	-	+	+
Tannins	+	-	+
Steroids	-	+	+
Saponin	-	+	+
Protein	-	+	+

Table 4. Preliminary phytochemical analysis of Alternanthera sessilis leaf extracts

Phytoconstituents	Acetone	Methanol	Water
Alkaloids	-	+	-
Saponins	+	+	-
Steroids	-	+	-
Sugars	-	+	-
Protein	-	+	+
Tannins	+	-	-
Flavonoids	+	+	-

3.2. Phytochemichal Analysis

Phytochemical screening of the aqueous and methanolic leaf extracts of Ervatamia coronaria revealed the presence of alkaloids, terpenoids, flavonoids, tannins, steroids, saponins and protein whereas the acetone extracts showed the presence of alkaloids, tannins and saponins (Table – 3). Most of the secondary metabolites were identified in the aqueous and methanol extracts. Phytochemical screening of the methanolic leaf extracts of A. sessilis revealed the availability of alkaloids, steroids, saponins, flavonoids and sugars whereas acetone extracts showed the presence of saponins, tannins and flavonoids (Table 4).

The present investigation revealed that alkaloids which are one of the characteristic secondary metabolite in leaves are seen to be present in considerable amounts in the leaves of the plants used in this study. Also, the presence of high amount of tannins in the leaf extracts studied here, suggests the efficiency of these against these selected bacterial pathogens. Therapeutically, tannin in plants has been reported to be effective in treating nonspecific diarrheoa, inflammations of mouth, throat and injured skins [11]. In this study, the high amounts of tannin in the leaf extracts might serve to use these plants as novel therapeutic agent. Similarly there have been many studies conducted on the antimicrobial activity of flavonoids [12, 13]. Flavonoids are known to be synthesized by plants in response to microbial infections. The bacterial and fungicidal effect of the flavonoids may be the result of a metabolic perturbation especially through complex formation of extracellular, soluble and cell wall proteins [14]. It was previously reported the presence of antimicrobial saponins from Sorghum bicolor L. Moench [15]. The search for drugs and dietary supplements derived from plants increased in recent years [16, 17]. The antibacterial activity reported here, in this investigation conducted in the extracts of the leaves of the two plants Ervatamia coronaria L. and

Alternanthera sessilis, may be due to the presence of flavonoids and saponins present in large amounts.

The present investigation revealed that phytochemicals such as alkaloids, flavonoids, saponins, tannins, terpenoids and steroids are highly distributed in the leaves of Ervatamia coronaria and Alternanthera sessilis. These phytoconstituents may play a vital role against various bacterial pathogens.

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