Contents lists available at ScienceDirect

Journal of Acute Disease

journal homepage: www.jadweb.org

Document heading doi: 10.1016/S2221-6189(13)60107-9

A review on antimicrobial efficacy of some traditional medicinal plants in Tamilnadu

MUNUSWAMY HEMALATHA[1], Thirunavukkarasu Thirumalai[2], Rajamani Saranya[1], Erusan Kuppan Elumalai[2], Ernest David[1*]

[1]*Department of Biotechnology, Thiruvalluvar University, Serkadu, Vellore-632115*
[2]*Post graduate and Research Department of Zoology, Physiology wing, Voorhees College, Vellore - 632001. Tamilnadu, India*

ARTICLE INFO

Article history:
Received 14 December 2012
Received in revised form 15 January 2013
Accepted 15 March 2013
Available online 20 June 2013

Keywords:
Medicinal plants
Flavonoids
Fungi
Antimicrobial activity

ABSTRACT

Infectious diseases are one of the major problems in developing as well as developed countries. Traditional medicinal plants are widely used to treat the microbial diseases due to their rich source of antimicrobial activity and less cost. The different plant parts such as seed, fruit, root, bark, stem, leaf and even the whole plant were extracted using different solvents like ethanol, methanol, chloroform, acetone, petroleum ether, alcohol, and ethyl acetate. These extracts were tested by diffusion method against gram positive, gram negative bacteria and fungi to assess their antimicrobial activity. This review provides a lucid data of nearly 70 traditional medicinal plants with antimicrobial activity and this would open up the scope for further analysis of medicinal plant extracts to develop effective antimicrobial drugs.

1. Introduction

Plants produce a diverse range of bioactive molecules, making them rich source of different types of medicines. Most of the drugs today are obtained from natural sources or semi synthetic derivatives of natural products used in the traditional systems of medicine[1]. Thus it is a logical approach in drug discovery to screen traditional natural products. Approximately 20% of the plants found in the world have been submitted to pharmaceutical or biological test and a sustainable number of new antibiotics introduced in the market are obtained from natural or semi synthetic resources[2].

Medicinal plants are finding their way into pharmaceuticals, cosmetics, and neutraceuticals. In pharmaceutical field medicinal plants are mostly used for the wide range of substances present in plants which have been used to treat chronic as well as infectious diseases[3]. Long before mankind discovered the existence of microbes, the idea that certain plants had healing potential, indeed, that they contained what we would currently characterize as antimicrobial principles, was well accepted. Since antiquity, man has used plants to treat common infectious diseases and some of these traditional medicines are still included as part of the habitual treatment of various maladies[4].

The drugs already in use to treat infectious disease are of concern because drug safety remains an enormous global issue. Most of the synthetic drugs cause side effects and also most of the microbes developed resistant against the synthetic drugs[5]. To alleviate this problem, antimicrobial compounds from potential plants should be explored. These drugs from plants are less toxic, side effects are scanty and also cost effective. They are effective in the treatment of infectious diseases while simultaneously mitigating many of the side effects that are often associated with synthetic antimicrobials[6].

According to World Health Organization (WHO) medicinal plants would be the best source to obtain a variety of drugs[7]. Several plant species are used

*Corresponding author: Dr. Ernest David, Professor and Head, Department of Biotechnology, Thiruvalluvar University, Serkadu, Vellore-632115.
Tel: +91-9345300236
E-mail: ernestdavid2002@yahoo.com

by many ethnic groups for the treatment of various ailments ranging from minor infections to dysentery, skin diseases, asthma, malaria and a horde of other indications[8]. Plant based antimicrobials represent a vast untapped source of medicines and further exploration of plant antimicrobials is the need of the hour. Antimicrobials of plant origin have enormous therapeutic potential. Plant-derived antimicrobials have a long history of providing the much needed novel therapeutics[9]. Plants constantly interact with the rapidly changing and potentially damaging external environmental factors. Being organisms devoid of mobility, plants have evolved elaborate alternative defense strategies, which involve an enormous variety of chemical metabolites as tools to overcome stress conditions.

The ability of plants to carry out combinatorial chemistry by mixing, matching and evolving the gene products required for secondary metabolite biosynthetic pathways, creates an unlimited pool of chemical compounds, which humans have exploited to their benefit. The use of plants by humans in both traditional and modern medicinal systems, therefore, largely exploits this principle[10]. The current review supports the updated systemic information on the use of herbal medicines and their chemical constituents for antimicrobial activity. We selected pre-reviewed papers on herbal medicines and their phytochemicals activity shown on scientific database Medline, Scopus, Science direct, Springer link, Wiley, Oxford journal and Google scholar. The following keywords were used to search for the literature inside the databases are phytochemicals, plant extract, natural product and antimicrobial. However, we excluded the papers on the antimicrobial effects of derivatives from herbal compound.

2. Traditional medicinal plants used in Tamilnadu

Tamilnadu is one of the most botanized areas of South India. A vast knowledge regarding how to use the plants against different illness may be expected to be accumulated in area where the use of plant still of great importance. The medicinal properties of those plants were studied by several workers in Tamilnadu.

It is very important to document the information about the medicinal plants from traditional healers to protect the knowledge of plant usage, because the younger generation is not interested to carry on the traditional knowledge. In Table 1 many medicinal plants are given, which are used by traditional healers for their antimicrobial properties. Hereby, the mentioned plants are taken from references which are already included in ethnobotanical surveys[11-17]. This paper reviews specifically about the plants having antimicrobial properties.

The increasing interest on traditional ethnomedicine may lead to discovery of novel therapeutic agent. Since, plant contains potential antimicrobial components that may be useful for evolution of pharmaceutical for the therapy of ailments.

Plants with possible antimicrobial activity should be tested against some microbes to confirm the activity. Researchers are increasingly turning their attention to folk medicine looking for new leads to develop better drugs against cancer, as well as viral and microbial infections. The activity of plant extracts on bacteria and fungi has been studied by a very large number of researchers in different place of the world. The specific plants to be used and the methods of application for particular ailments were passed down through oral tradition. Plants with possible antimicrobial activity should be tested against some microbes to confirm the activity[12]. Table 2 comprise the details of plants having antimicrobial properties, which are scientifically tested.

3. Bioactive compounds

The medicinal value of plants lies in some chemical substances that produce a definite physiological action on the human body and these chemical substances are called phytochemicals. These phytochemicals were used to cure the disease in herbal and homeopathic medicines[18]. These are non-nutritive substances, have protective or disease preventive property[19]. There arises a need and therefore to screen medicinal plants for bioactive compounds as a basis for further pharmacological studies. With advances in phytochemical techniques, several active principles of many medicinal plants have been isolated and introduced as valuable drug in modern systems of medicine.

The most important of these bioactive compounds are alkaloids, flavonoids, tannins and phenolic compounds[20]. These are the important raw materials for drug production[21]. Most plants contain several compounds with antimicrobial properties for protection against aggressor agents, especially microorganisms[22]. Table 3 comprise the details of bioactive compounds isolated from medicinal plants.

4. Conclusion

This review suggests that the 70 medicinal plants posses compounds with antimicrobial properties

Table 1
Medicinal plants used for the treatment of antimicrobial disease.

Botanical name	Family	Local name	Parts	Mode of action/aliments
Acacia nilotica	Mimosaceae	Karuvelam	St	Young stem is used as toothbrush. Toothache
Achyranthes aspera	Amaranthaceae	Nayuruvi	L	Decoction of leaf is used for skin eruption.
Acorus calamus	Araceae	Vasambu	Rh	Dried rhizome is given orally for throat infection.
Aegele marmelos	Rutaceae	Vilvam	L	Juice of leaf extract applied for eye disease.
Aerva lanata	Amaranthaceae	Sirupeelai	WP	Juice of whole plant is taken orally for cough, sore throat
Ageratum conyzoides	Asteraceae	Sethupunthalai	L	Leaves paste mixed with common salt is applied on affected part in skin diseases and itches
Alangium salvifolium	Alangiaceae	Alangimaram	F	Fruit juice is used for eye disease; Leaf pastes is applied externally skin disease
Andrographis alata	Acanthaceae	Periyanangai	L	Fresh leaves juice given orally twice a day for fever; Leaves juice given orally for four to six days for diarrhoea
Andrographis echioides	Acanthaceae	Gopuram thangi	L	Leaf paste is applied externally on cuts and wounds
Andrographis paniculata	Acanthaceae	Nilavembu	L	Leaf paste is applied externally for skin diseases
Andrographis serpyllifolia	Acanthaceae	Siyankodi	L	Decoction of leaves is used to treat fever
Annona squamosa	Annonaceae	Sitapalam	L	Leaf extract is taken orally for diarrhea
Aristolochia bracteolate	Aristolochiaceae	Aaduthinnapalai	L	Leaf paste is externally used for skin disease
Azadirachta indica	Meliaceae	Vembu	L	Leaf paste applied externally with some other medicinal plants for skin diseases
Calotropis gigantean	Asclepiadaceae	Erukku	Lx	Milky latex is applied on the wounds on leg
Carissa carandas	Apocynaceae	Kalakka	L	Decoction of leaves given for fever
Curcuma longa	Zingiberaceae	Manjal	Rh	Rhizome extract is used for itches, skin eruption
Cynodan dactylon	Poaceae	Arugampul	R	Root decoction is given to treat fever
Euphorbia hirta	Euphorbiaceae	Amanpacharisi	Lx, L	Latex is applied externally for pimples; Leaves mixed with common salt and cow's milk is used todysentery and treat diarrhea
Justicia adhotada	Acanthaceae	Adathoda	L	Leaf juice given orally for dysentery
Leucas aspera	Lamiaceae	Thumbai	L	Fresh leaf juice mixed with turmeric powder is applied externally for throat infections
Mangifera indica	Anacardiaceae	Mamaram	B	Decoction of bark used for diarrhea
Mimusops elengi	Sapotaceae	Magizham	L	Leaves are boiled with water and decoction used as a cleansing agent for mouth to cure disease of gums and teeth.
Plectranthus coleoides	Lamiaceae	Omavalli chedi	L	Leaf paste applied once in two days and burns
Psidium guajava	Myrtaceae	Koyya	L	Leaves are used to treat dysentery
Scantalum album	Santalaceae	Santhana maram	St	Shoot paste on applied externally for skin disease
Sesbania grandiflora	Fabaceae	Agatthi	L	Juice of leaves is mixed with coconut milk and the mixture is applied topically for skin eruption
Solanum surattense	Solanaceae	Kandankathiri	F	Fruit paste given orally twice a day for one week for tooth ache
Sphaeranthus indicus	Asteraceae	Kottaikkaratai	Sd	Seeds are ground into place and applied topically for skin disease
Tribulus terrertris	Zygophyllaceae	Nerunchi	WP	Decoction of the whole plant is taken internally for urinary disorder
Tridax procumbens	Asteraceae	Vettukayapoondu	L	Leaf paste is used externally used to treat cuts and wounds
Vitex negundo	Verbenaceae	Nochi	L	Leaf used to treat cold
Zingeber offcinalsis	Zingiberaceae	Inji	Rh	Juice of rhizome with honey is taken internally to improve digestion and relieve giddiness

Abbreviations: Parts used = L: Leaves, F: Fruit, St: Stem, S: Shoot, R: Root, WP: Whole plant, Lx: Latex, Rh: Rhizome, Sd: Seed.

Table 2
Antimicrobial screening performed on various medicinal plants.

Botanical name	Family	Tamil name	Parts used	Extracts	Organism inhibited			Reference
					Gram positive	Gram negative	Fungi	
Achyranthes aspera	Amaranthaceae	Nayuruvi	R	C,M	*Staphylococcus aureus*	*Escherichia coli*, *Bacillus subtiliss* *Proteus vulgeris*	Nil	[23]
Alternanthera sessile	Amaranthaceae	Ponnaganni	v	E	*Streptococcus pyogenes*	*Salmonella typhi*	Nil	[24]
Aristolochia indica	Aristolochiaceae	Isvara mulli	L	E	Nil	Nil	*A. niger* *A. flavus* *A. fumigatus*	[25]
Azadirachta in dica	Meliaceae	Vembu	L	M	*Micrococcus luteus*	*Proteus vulgeris*	Nil	[26]
Capsicum frutescens	Solanaceae	Milaga	F	E	Nil	*Pseudomonas aeruginosa*	Nil	[27]
Cinnamomun zeylanicum	Lauraceae	Lavangapattai	L, B.	PE, C, EA, A, E.	Nil	Nil	*A. solani* *C. lunat*	[28]
Clerodendrum inerme L	Verbenaceae	Peechangu	L	M	*Staphylococcus aureus*	Nil	*A. niger*	[29]
Cola acuminate	Sterculiaceae	v	S	A,M	*Staphylococcus aureus*	Nil	*C. albicans*	[30]
Dahlia pinnata	Asteraceae	Deri	L	C	Nil	*Enterobacter arerogenes*, *Pseudomonas aeruginosa*	Nil	[31]
Eclipta prostrata L	Asteraceae	Karisilanganni	L	E	Nil	*Salmonella typhi*	Nil	[32]
Euphorbia hirta	Euphorbiaceae Amman	Pacharisi	WP	v	*Staphylococcus aureus*	*Escherichia coli*	Nil	[33]
Oxystelam esculentum	Asclepiadaceae	Uchippalai	L	EA	Nil	*Escherichia coli*	Nil	[34]
Ocimum sanctum	Lamiaceae	Tulasi	WP	M	*Staphylococcus aureus*, *Staphylococcus saprophytic*	Nil	Nil	[35]
Plumeria alba	Apocynaceae	Perumallari	P	M	Nil	*Escherichia coli*	Nil	[36]
Polyalthia cerascides	Annonaceae	Nedunar	SB	DCM	*Corynebacterium dipthieriae*		Nil	[37]
Plumeria ruba	Apocynaceae	Perungalli	L	A, E, C,EA	*Staphylococcusepidermidis*	*Escherichia coli*	Nil	[38]
Piper nigrum	Piperacea	Milagu	B	A, DCM	*Staphylococcus aureu*, *Streptococcus fecalis*	*Pseudomonas aeruginosa*, *Bacillus cereus* *Escherichia coli*, *Salmonella typhi*	Nil	[39]
Phyllanthus amarus	Euphorbiaceae	Keelanelli	L	E	Nil	*Salmonella typhi*	Nil	[40]
Spinifex littoreus	Poaceae	Vettiver	G	A	Nil	Nil	Dermatophytes	[41]
Terminalia chebula	Combretaceae	Kaddukai	F	E	*Staphylococcus aureus*, *Staphylococcus epidermidis*	*Salmonella typhi* *Pseudomonas aeruginosa* *Bacillus subtillis*	Nil	[42]

Abbreviations: Parts used = L: Leaves, G: Grass, F: Fruit, SB: Stem bark, S: Shoot, R: Root, WP: Whole plant, Lx: Latex, Rh: Rhizome.
Extracts= A: Aqueous, C: Chloroform, E: Ethanol, E: Ethyl acetate, M: Methanol, PE: Petroleum ether, DCM: Dichloromethane.

Table 3
Bioactive compounds obtained from medicinal plants.

Botanical name	Family	Local name	Bioactive compound	Organisms inhibited	Reference
Acacia nilotica	Fabaceae	Karuvelai	Alkaloids	*Staphylococcus aureus*	[43]
Artocarpus communis	Moraceae	Seemapila	AtoninE, 2-[(3,5-dihydroxy)-(Z)-4-(3-methylbut-1-etnyl)	*Pseudomonas aeruginosa*	[44]
Ageratum fastigiatum	Asteraceae	Poompul	β-caryophyllene, Phenyl] benzofuran-6-ol	*Staphylococcus mutans, Staphylococcus aureus, Staphylococcus faecalis Escherichia coli*	[45]
Allium sativam	Liliaceae	puntu	Allicin	*Candida*	[46]
Camellia sinensis	Theaceae	Thayilar	Catechin	*Staphylococcus mutans*	[47]
Cassia alata	Fabaceae	Seemaiagathi	4-butylamine 10-,cannabinoid dronabinol ,methyl-6-hydroxy	*Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Candida albicans*	[48]
Cassia fistula	Fabaceae	Sarakkonrai	4-hyd roxy benzoic acid hydr ate	*Trichophyton mentagraphytes, Epidermophyton floccosum*	[49]
Cinnamomun zeylanicum	Lauraceae	Lavangapattai	Cinnamaldehyde	*Helicobacter pylori*	[50]
Cinnamomun inerme	Lauraceae	Kattukkaruvapattai	[5-(1,5-dimethyl-2-4-hexenyl) -methyl phenol]	*Staphylococcus aureus, Escherichia coli*	[51]
Hybanthus enneaspermus	Violaceae	Orithazh thamari	Flavonoids, Tannins	*Proteus, Vibrio cholera*	[52]
Mentha piperita	Lamiaceae	Puthina	1,1-diphenyl-2-picrylhydrazyl - hydrate	*Staphylococcus aureus, Escherichia coli, Candida albicans*	[53]
Matricaria chamomilla	Asteraceae	Mookuthipoo	Phenolic acid	*Salmonella typhimurium*	[54]
Ocimum basilicum	Lamiaceae	Thirunittru pachilai	Terpenoids	*Salmonella*	[55]
Polyalthia cerasoides	Annonaceae	Nedunari	N-(4-hydroxy-β-phenethyl-4-hydroxycinnamide)	*Corynebacterium diptrtheriae*	[56]
Piper nigrum	Piperaceae	Milagu	Piperine	*Lactobacillus, Escherichia coli, Micrococcus*	[57]
Senna petersiana	Fabaceae	Vagaai	Luteolin (Flavonoid)	*Bacillus cereus and Staphylococcus aureus*	[58]
Tricnoderrma indicum	Boraginaceae	Kasi thumbai	Lanast-5-en-3 β-D-glucopyranosyl-21(24)-oilde	*Staphylococcus aureus*	[59]
Tecoma stans	Bignoniaceae	Swarna pattai	Phenoilc compound	*Staphylococcus aureus*	[60]

which could be used as antimicrobial agents. Also it is the most useful for scientists, research scholars and scientific companies to carry out further studies on isolation and identification of active compounds that can be formulated into antimicrobial drugs.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgments

Authors are thankful to Department of Biotechnology, Thiruvalluvar University, Vellore, Tamilnadu, for providing facilities during preparation of this review article.

References

[1] Sukanya SL, Sudisha J, Hariprasad P, Niranjana SR, Prakash HS, Fathima SK. Antimicrobial activity of leaf extracts of Indian medicinal plants against clinical and phytopathogenic bacteria. *Afr J Bio* 2009; **8**(23): 6677-6682.

[2] Mothana RA, Lindequist U. Antimicrobial activity of some medicinal plants of the island Soqotra. *J Ethnopharmacol* 2005; **96**(1-2): 177-181.

[3] Okigbo RN, Anuagasi CL, Amadi JE. Advances in selected medicinal and aromatic plants indigenous to Africa. *J Med Plant Res* 2009; **3**(2): 86-95.

[4] Rios JL, Recio MC. Medicinal plants and antimicrobial activity. *J Ethnopharmacol* 2005; **100**: 80-84.

[5] Chanda S, Rakholiya K. Combination therapy: Synergism between natural plant extracts and antibiotics against infectious diseases. *Microbiol Book Series* 2011; 520-529.

[6] Harishchandra MR, Rajan PR, Singh Satyendrakumar RP. Study of krimighna effect of nimba (*Azadiracta indica* A.Juss.) Patra as rakshoghna dhoopan by culture and sensitivity method W.S.R. to pyogenic bacteria. *IRJP* 2012; **3**(6):142-146.

[7] Nascimento GF, Lacatelli J, Freitas PC, Silva GL. Antibacterial activity of plant extracts and phytochemicals on antibiotic-resistant bacteria. *Brazilian J Microbiol* 2000; **31**(4): 886-891.

[8] Dahanukar SA, Kulkarni RA, Rege NN. Pharmacology of medicinal plants and natural products. *Ind J Pharmacol* 2000; **32**: 81-118.

[9] Silva MSP, Brandao DO, Chaves TP, Filho ALNF, Costa EMDB, Santos VL, et al. Study bioprospecting of medicinal plant extracts of the semiarid Northeast: Contribution to the control of oral microorganisms. *Evi-Based Comp Alt Med* 2012; 2012: 1-6.

[10]Ncube B, Finnie JF, Staden JV. *In vitro* antimicrobial synergism within plant extract combinations from three South African medicinal bulbs. *J Ethnopharmacol* 2012; **139**: 81-89.

[11]Bhaskar A, Samant LR. Traditional medication of Pachamalai Hills, Tamilnadu, India. *Global J Pharmacol* 2012; **6** (1): 47-51.

[12]Duraipandiyan V, Ignacimuthu S. Antifungal activity of traditional medicinal plants from Tamil Nadu, India. *Asian Pac J Trop Biomed* 2011; **1**(2): S204 - S215.

[13]Alagesaboopathi C. Ethnobotanical studies on useful plants of Kanjamalai Hills of Salem district of Tamil Nadu, Southern India. *Arch App Sci Res* 2011; **3** (5): 532-539.

[14]Rajadurai M, Vidhya VG, Ramya M, Bhaskar A. Ethno-medicinal plants used by the traditional healers of Pachamalai Hills, Tamilnadu, India. *Ethno-Med* 2009; **3**(1): 39-41.

[15]Beverly CD, Sudarsanam G. Ethnomedicinal plant knowledge and practice of people of Javadhu hills in Tamilnadu. *Asian Pac J Trop Biomed* 2011; **1**(1): S79-S81.

[16]Ignacimuthu S, Ayyanar M, Sivaraman SK. Ethnobotanical investigations among tribes in Madurai District of Tamil Nadu (India). *J Ethnobiol Ethnomed* 2006: 2.

[17]Hema DN, Mahomoodally MF. Ethnopharmacological survey of native remedies commonly used against infectious diseases in the tropical island of Mauritius. *J Ethnopharmacol* 2012; **143**(2): 548-564.

[18]Chitravadivu C, Manian S, Kalaichelvi K. Antimicrobial studies on selected medicinal plants, Erode region, Tamilnadu, India. *Middle-East J Sci Res* 2009; **4** (3): 147-152.

[19]Ahmed F, Urooj A. Glucose-lowering, hepatoprotective and hypolipidemic activities of stem bark of *Ficus racemosa* in streptozotocin induced diabetic rats. *J Young Pharm* 2009; **1**(2): 160-164.

[20]Purkayastha S, Dahiya P. Phytochemical analysis and antibacterial efficacy of babchi oil (*Psoralea corylifolia*) against multi-drug resistant clinical isolates. International Conference on Bioscience, Biochemistry and Bioinformatics. *IPCBEE* 2012; **3**(1): 64-68.

[21]Tullanithi KM, Sharmila B, Gnanendra TS. Preliminary phytochemical analysis and antimicrobial activity of *Achyranthes aspera* Linn. *Int J Bio Tech* 2010: **1**(3): 35-38.

[22]Silva NCC, Júnior AF. Biological properties of medicinal plants: a review of their antimicrobial activity. *J Veno Ani Tox Inclu Trop Dis* 2010; **16**(3): 402-431.

[23]Beaulah AG, Sadiq AM, Santhi RJ. Antioxidant and antibacterial activity of *Achyranthes aspera*: An *in vitro* study. *Der Pharma Chemica* 2011; **3** (5): 255-262.

[24]Johnson M, Wesely EG, Selvan N, Kavitha MS. *In vivo* and *in vitro* anti-bacterial efficacy of *Alternanthera sessilis*(Linn.). *Int J Pharma Res Develop* 2010; **2**(10): 72-79.

[25]Kumar SM, Rajeswari, Astalakshmi M. Evaluation of antimicrobial activities of *Aristolochia Indica* (Linn). *Int J Pharm Pharma Sci* 2011; **3** (4): 271-272.

[26]Koona S, Budida S, Antibacterial potential of the extracts of the leaves of *Azadirachta indica* Linn. *Not Sci Bio* 2011; **3** (1): 65-69.

[27]Soetarno S, Sukrasn O, Yulinah E. Antimicrobial activities of the ethanol extracts of capsicum fruits with different levels of pungency. *JMS* 1997; **2** (2): 57-63.

[28]Ajay KM, Mishra A, Kehri HK, Pandey BSAK. Inhibitory activity of Indian spice plant Cinnamomum zeylanicum extracts against *Alternaria solani* and *Curvularia lunata*, the pathogenic dematiaceous moulds. *Ann Cli Micro Antimicro* 2009; **8**:1-9.

[29]Chahal JK, Sarin R, Malwal M. Efficacy of *Clerodendrum inerme* L. (Garden Quinine) against some human pathogenic strains. *Int J Pharma Bio Sci* 2010; **1**(4): 219-223.

[30]Shama IY, Adam, Ahmed AN, Yahya, Wala MM, Salih, et al. Antimicrobial activity of the masticatory *Cola acuminata* Nut (Gooro). *Curr Res J Bio Sci* 2011; **3** (4): 357-362.

[31]Bissa S, Bohra A, Bohra A. Screening of Dahlia pinnata for its antimicrobial activity. *J Res Bio* 2011; **1**(2011): 51-55.

[32]Karthikumar S, Vigneswari K, Jegatheesan K. Screening of antibacterial and antioxidant activities of leaves of *Eclipta prostrata* (L). *Sci Res Essay* 2007; **2** (4): 101-104.

[33]Ogueke CC, Ogbulie JN, Okoli IC, Anyanwu BN. Antibacterial activities and toxicological potentials of crude ethanolic extracts of *Euphorbia hirta*. *J Amer Sci* 2007; **3** (3): 11-16.

[34]Khan AV, Ahmad R, Khan AA, Shukla I. Antibacterial activity of *Oxystelma esculentum* leaf extracts against some hospital isolated human pathogenic bacterial strains. *J Herb*

Med Toxicol 2008; **2** (2): 67-70.

[35]Kumar A, Tantry BA, Rahiman S, Kumar S. Antibacterial evaluation and phytochemical screening of methanolic extract of *Ocimum sanctum* against some common microbial pathogens. *Aus J Bas Appl Sci* 2011 (In press).

[36]Syakira MH, Brenda L. Antibacterial capacity of *Plumeria alba* petals. *World Aca Sci*, *Engi Tech* 2010; **68**: 1463-1466.

[37]Treeratanapiboon L, Worachartcheewan A, Suksrichavalit T, Kiatfuengfoo R, Prachayasittikul S, Ruchirawat S, et al. Bioactive 4-Hydroxycinnamide and bioactivities of *Polyalthia cerasoides*. *EXCLI J* 2011; **10**: 16-22.

[38]Baghel AS, Mishra CK, Rani A, Sasmal D, Nema RK. Antibacterial activity of *Plumeria rubra* Linn. plant extract. *J Chem Pharma Res* 2010; **2**(6): 435-440.

[39]Karsha PV, Bhagyalakshmi O. Antibacterial activity of black pepper (*Piper nigrum* Linn.)with special reference to its mode of action on bacteria. *Ind J Natural Prod Res* 2010; **1**(2): 213-215.

[40]Oluwafemi F, Debiri F. Antimicrobial effect of *Phyllanthus amarus* and *Parquetina nigrescens* on *Salmonella typhi*. *Afri J Biomed Res* 2008; **11**: 215-219.

[41]Thirunavukkarasu P, Ramanathan T, Ramkumar L, Balasubramanian T. Anti microbial effect of a coastal sand dune plant of *Spinifex littoreus* (Burm. f.) Merr. *Current Res J Biol Sci* 2010; **2**(4): 283-285.

[42]Kannan P, Ramadevi SR, Hopper W. Antibacterial activity of *Terminalia chebula* fruit extract. *Afri J Micro Res* 2009; **4**: 180-184.

[43]Vijayasanthi M, Kannan V, Venkataswamy R, Doss A. Evaluation of the antibacterial potential of various solvent extracts of *Acacia nilotica* linn. leaves. *Hygeia J D Med* 2012; **4**(1): 91-96.

[44]Kuete V, Ango PY, Fotso GW, Kapche GDWF, Dzoyem JP, Wouking AG, Ngadjui, et al. Antimicrobial activities of the methanol extract and compounds from *Artocarpus communis* (Moraceae). *BMC Com Altern Med* 2011; **11**(42): 1-5.

[45]Vieira GDV, Sousa OV, Yamamoto CH, Kaplan MAC. Chemical composition and antimicrobial activity of the essential oils of *Ageratum fastigiatum* (Asteraceae). *Rec Nat Prod* 2009; **3**(1): 52-57.

[46]Ari MM, Barde RE, Ogah DM, Agade Y, Yusuf ND, Hassan ID, et al. Utilization of garlic (*Allium sativum* L) as asupplementary phytogenic feed additive for broilers fed commercial feeds. *Egypt Poult Sci* 2012; **32** (I): 13-21.

[47]Taylerson K. The health benefits of tea varieties from *Camellia sinensis*. *Ply Stud Scist* 2012; **5** (1): 304-312.

[48]Okwu DE, Nnamdi FU. Cannabinoid dronabinol alkaloid with antimicrobial activity from *Cassia alata* Linn. *Der Chemica Sinica* 2011; **2** (2): 247-254.

[49]Duraipandiyan V, Ignacimuthu S. Antibacterial and antifungal activity of *Cassia fistula* L.:an ethnomedicinal plant. *J Ethnopharmacol* 2007; **112** (3): 590-594.

[50]Uma B, Prabhakar K, Rajendran S, Lakshmi Sarayu Y. Studies on GC/MS Spectroscopic analysis of some bioactive antimicrobial compounds from *Cinnamomum zeylanicum*. *J Med Plants* 2009; **8** (31): 125-131.

[51]Mustaffa F, Indurkar J, Ismail S, Shah M, Mansor MS. An antimicrobial compound isolated from *Cinnamomum iners* leaves with activity against methicillin-resistant *Staphylococcus aureus*. *Molecules* 2011; **16**: 3037-3047.

[52]Bharathi SV, Nithya TG, Sivakumar, Banu S, Lakshmi M. Screening of bioactive compounds and antimicrobial effect of *Orithazh thamarai* chooranam. *Int J Pharm Tech Res* 2012; **4**(2): 572-575.

[53]Pramila DM, Xavier R, Marimuthu K, Kathiresan S, Khoo ML, Senthilkumar M, et al. Phytochemical analysis and antimicrobial potential of methanolic leaf extract of peppermint (*Mentha piperita*: Lamiaceae). *J Med Plant Res* 2012; **6**(2): 331-335.

[54]Mukhopadhyay MK, Banerjee P, Nath D. Phytochemicals-biomolecules for prevention and treatment of human diseases-a review. *Int J Sci Eng Res* 2012; **3**(7): 1-32.

[55]Wan J, Wilcock A, Coventry MJ. The effect of essential oils of basil on the growth of *Aeromonas hydrophila* and *Pseudomonas fluorescens*. *J Appl Microbiol* 1998; **84**:152-158.

[56]Treeratanapiboon L, Worachartcheewan A, Suksrichavalit T, Kiatfuengfoo R, Prachayasittikul S, Ruchirawat S, et al. Bioactive 4-hydroxycinnamide and bioactivities of *Polyalthia cerasoides*. *EXCLI J* 2011; **10**: 16-22.

[57]Ghoshal S, Krishna Prasad BN, Lakshmi V. Antiamoebic activity of *Piper longum* fruits against *Entamoeba histolytica in vitro* and *in vivo*. *J Ethnopharmacol* 1996; **50**: 167-170.

[58]Tshikalange TE, Meyer JJM, Hussein AA. Antimicrobial activity, toxicity and the isolation of a bioactive compound from plants used to treat sexually transmitted diseases. *J Ethnopharmacol* 2005; **96** (3): 515-519.

[59]James BP, Sharma SK, Pillai KK, Pandurangan A, Kesavan D. Evaluation of antimicrobial activity of ethanol extract and compounds isolated from *Trichodesma indicum* (Linn.) R.Br.root. *J Ethnopharmaco* 2012; **142** (1): 283-286.

[60]Govindappa M, Sadananda TS, Channabasava R, Jeevitha MK, Pooja KS, Raghavendra VB. Antimicrobial, antioxidant activity and phytochemical screening of *Tecoma stans* (l.) Juss. Ex kunth. *J Phytol* 2011; **3**(3): 68-76.